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An International Review of Forestry and Forest Products

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Vol. V, No. 4 **October-December 1951**

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Cover photograph : The Rock Creek fire of 16 August, 1927. Douglas fir snaps and logs are burning briskly at night. Rock Creek is in the Columbia National Forest, Washington.

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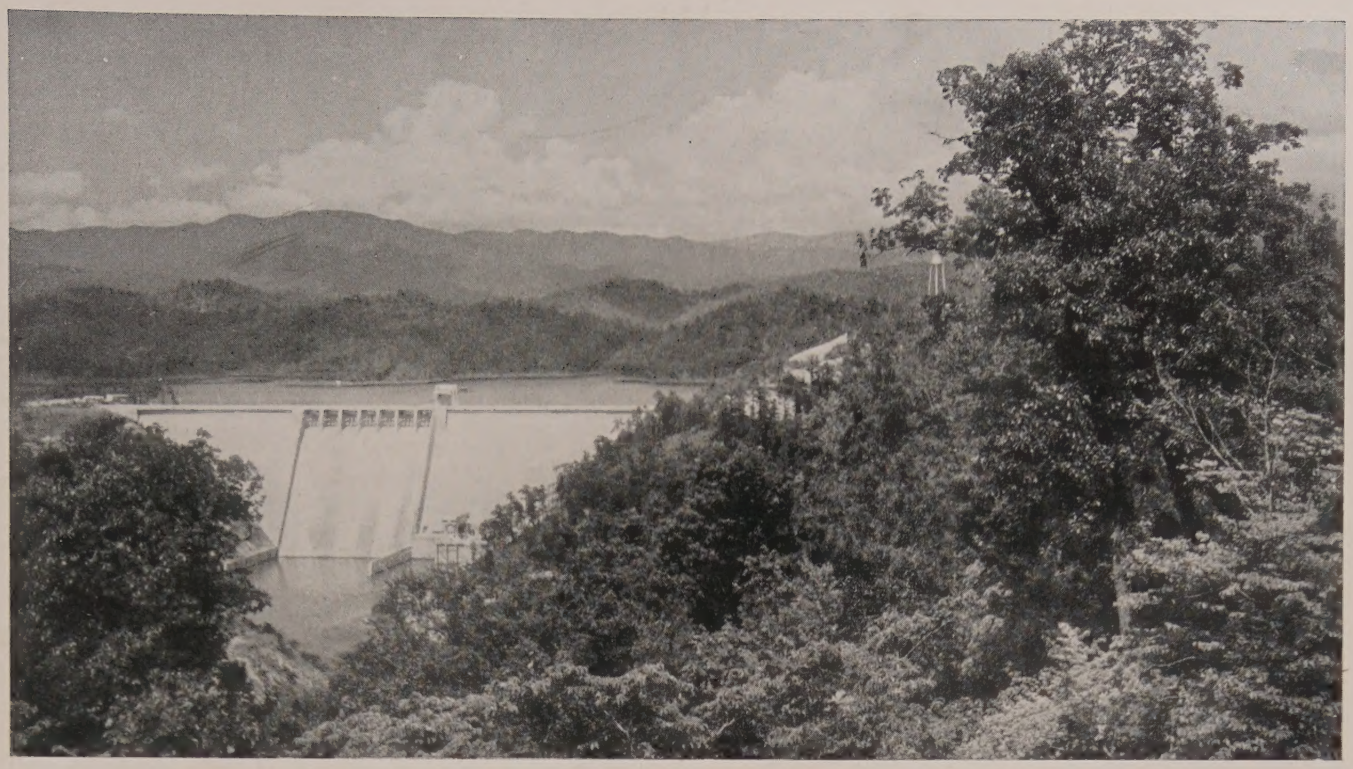


Editorial

INTEGRATED LAND DEVELOPMENT

DURING the summer of 1951, FAO organized a Land Utilization Conference in Ceylon for countries of the Asia and Far East Region which many foresters attended.

Summarizing its discussions, the Conference declared that the catchment area of a stream, large or small, was the natural unit for land development because of the importance to such development of the utilization and control of the flow of waters. It called attention to the need for international co-operation in developing the resources of catchment areas that served more than one country, thus echoing the plea of FAO's Mysore Forestry Conference of 1949.

The Conference affirmed that the basic facts about land, water and other resources — their inherent characteristics, potentialities and economic uses — should be sought and compiled in a comprehensive resource-inventory before decisions concerning their development were made. Such inventories should be the basis for planning the integrated development of a region and its varied resources.

In this issue of *Unasylva* an article deals with what is, perhaps, the best known example of systematic integrated land development, that of the Tennessee Valley in the United States of America. Two years ago at the United Nations Scientific Conference on the Conservation and Utilization of Resources, Mr. H.L. Keenleyside (now Director of the United Nations Technical Assistance Administration) spoke of that project as follows:

"Conceived in something approaching desperation, authorized as a result of political courage and imagination of the highest order, executed by the people of the valley itself under the guidance of engineers and technicians and social scientists of unusual competence and conscience, guided from the beginning by an administration that was able to combine sound executive practises with adherence to democratic practises, the Tennessee Valley project is today a steadily increasing proof that political, social and scientific techniques can be successfully integrated for the permanent advantage of depressed humanity and the benefit of the nation."

Schematic drawing of the TVA water control system. Topographical lay-out is shown bottom right.

Forest Development in the Tennessee Valley

by J. O. Artman,

Staff Forester, Division of Forestry Relations, Tennessee Valley Authority

The Tennessee Valley Authority (TVA) was created by the Congress of the United States in March 1933. It is a regional agency of the federal government, functioning as a government corporation. According to the preamble of the Act that created it, TVA is to :

> " improve the navigability and provide for flood control of the Tennessee River ;
>
> " provide for reforestation and the proper use of marginal lands in the Tennessee Valley ;
>
> " provide for the agricultural and industrial development of the said Valley ;
>
> " provide for the national defense by the creation of a corporation for the operation of government properties at and near Muscle Shoals in the State of Alabama, and for other purposes. "

The engineering accomplishments of TVA are well known — how the Tennessee River has been harnessed by a series of multipurpose dams to control flood, aid navigation, and produce hydro-electric power. The 30 dams and reservoirs now in operation within the Tennessee River watershed provide about 22,433,000 cu.ft./acre (1,570,000 m^3/ha.) of water storage. Nine of these dams on the Tennessee River itself provide a 9-foot (2.7 m.) navigation channel from the mouth of the river 630 miles (1,014 Km.) upstream to the city of Knoxville, Tennessee. In 1950 the TVA power system generated 17,700 million kilowatt-hours of electric energy. These are the things for which TVA is best known. In fact, most people still think of TVA only as a builder of dams and a producer of power. Too few realize the full significance of what is happening in other phases of resource development throughout the 26 million-acre (10.5 million ha.) watershed, which includes parts of seven states.

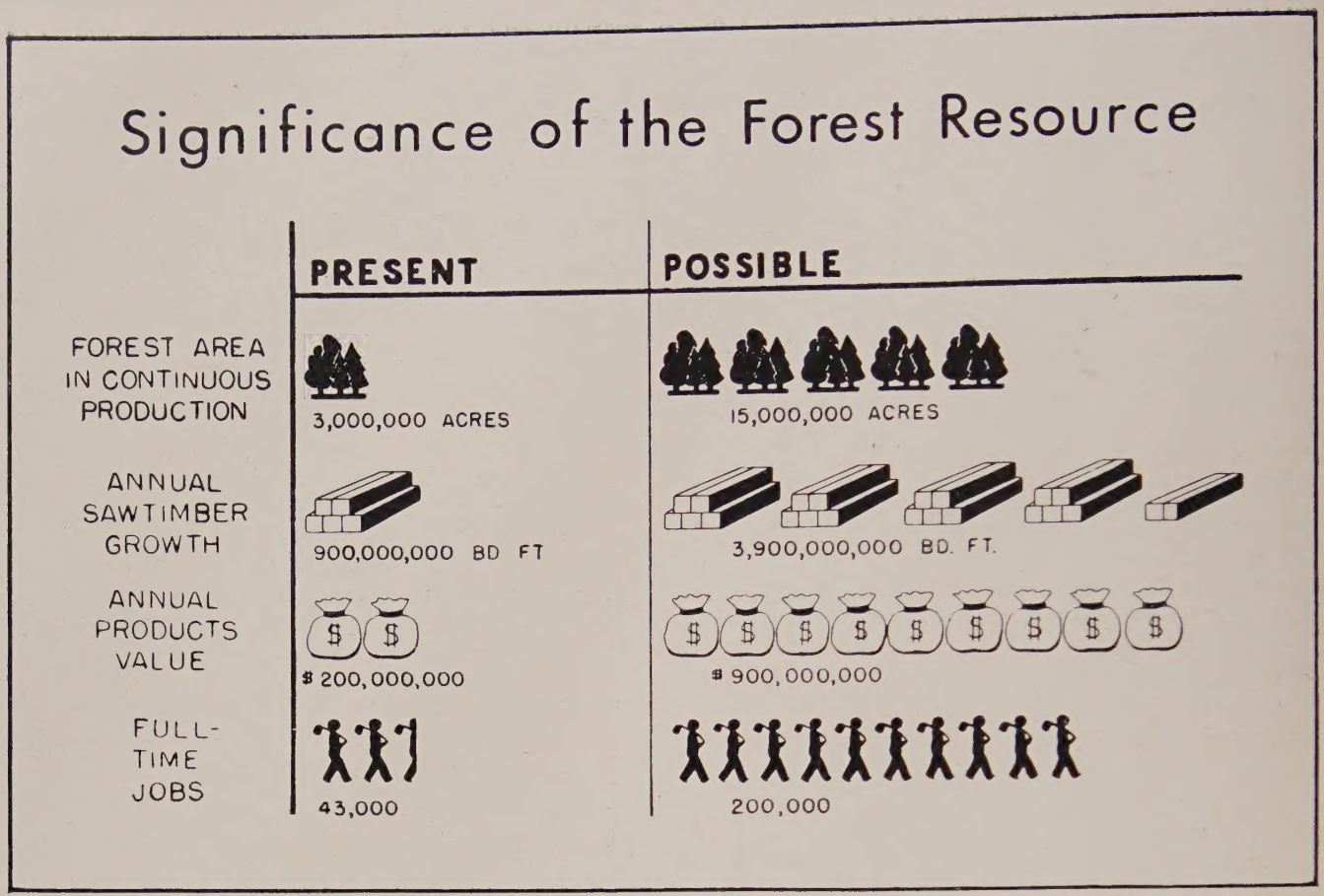
The Act of Congress which created TVA authorizes it to explore, study, test, and demonstrate the most effective measures for restoring and developing the full productive capacity of the region's lands and waters, and for utilizing most efficiently the resources and products they yield. The program developed from this authorization is therefore largely exploratory and investigative. The search is not only for more effective methods of watershed protection and resource development, but also for developing ways and means of bringing the interests and functions of the federal government closer to the people of the region, their problems and opportunities. The Tennessee Valley program is also co-operative, and every effort has been made to work with and through established groups, institutions, and agencies of the government, in order to avoid duplication of effort. Because problems of water control, land use, and resource development are so interrelated, they cannot be solved piecemeal or independently of each other. The Tennessee Valley program must therefore be a comprehensive, unified one. It must recognize the unity of nature and the relation of resources one to another. Finally, the program is an educational one. TVA has no regulatory control over the resources of the area, and progress depends almost entirely on the persuasive force of factual knowledge and demonstration. When people know the facts, they will usually conduct their affairs so that the public interest as well as their own private interest is served.

Tennessee Valley Forests

Fourteen million acres (5.7 million ha.) of the 26 million acres (10.5 million ha.) in the Valley are now classed as forest land. The timber is predominantly secondgrowth hardwood, with only about a third of the area supporting pure coniferous stands. Excessive cutting and fire have depleted the forests generally so that they are now only about one-third as productive as they should be. Only 17 percent of the forest land is publicly owned, the remainder being in private ownership, with about half located on farms. Small holdings are the rule ; over 7.5 million acres (3.0 million ha.) are in tracts of less than 500 acres (202 ha.).

In 1948 there were 5,075 sawmills operating in the Tennessee Valley counties. In addition, there are over 1,400 other forest products industries, including furniture, cooperage, and dimension mills, pulp and paper mills, tannin extract plants, planing mills, and concentration yards of various kinds. The value of the products manufactured in a single year by these establishments, which provide over 43,000 man-days of employment annually, is estimated at $200 million. This, however, is only a fraction of the potential value. With full timber production, adequate protection and management, and more efficient wood utilization, forest product values could be raised to $900 million a year. Employment could be increased to 200,000 man-days a year.

This estimate does not include the more intangible values and benefits that come from better watershed protection in this region of heavy rainfall, nor does it



Present and potenzial production of the TVA forests are compared above. The situation is typical of that in many other areas whose forest resources are not scientifically handled.

include the scenic attractions and recreational opportunities that forests contribute to the public enjoyment. These are additional returns from forests, and it is entirely possible that in the end they may exceed the cash values placed on wood and wood products.

Major Problems

The Tennessee Valley forest development program is designed to solve four problems :

1. *Fire control.* In the past the fire hazard in the Tennessee Valley area has been so great as to discourage ownership of forest land. More than five percent of the total forest area was burned in a single year. Public interest in fire control was lacking and state forestry agencies were underfinanced and understaffed. Prior to 1933 less than half of the privately owned forest land received organized protection ; none of it was adequately protected. The situation is much better today but there is still room for improvement. Eleven million (4.5 million ha.) of the 14 million acres (5.7 million ha.) of forest land are now protected by federal or state agencies. On 85 percent of this protected area protection is adequate or near adequate ; on only 15 percent is it still inadequate. The present great need is to extend protection to the three million acres (1.2 million ha.) that still lack any protection at all.

2. *Private forest lands not managed for sustained yield.* The public forests of the Valley, for the most part, are now managed for sustained yield. In addition, nearly half a million acres (202,000 ha.) of private forests, approximately 20 percent of the total forest area, are operated under management plans designed to build up growing stock and increase annual production. On the other 80 percent there is no conscious effort on the part of the owner to achieve sustained, maximum yield and to balance growth and drain. Timber management is a new idea to most landowners. They have never thought of timber as a crop and few of them know how to go about increasing production and sustaining it at a high level. They are willing to learn, however, and the facilities for getting information to them are gradually being developed.

3. *Need for Reforestation.* About 1.5 million acres (607,000 ha.) of land in the Valley is in need of reforestation. Roughly one-third is eroded to such an extent that it is no longer suitable for agriculture, another third is land that was once farmed unsuccessfully and is now idle, and the remainder is forest land that for one reason or another is understocked and needs reinforcing. Since 1934, 182,000 acres (74,500 ha.) have been reforested, that is, about 10 percent of the total area to be covered. Since the planting is done by the owners of the land, progress is limited by their interest and willingness to provide the labor. During the last two planting seasons, 10,700 landowners planted 32 million trees on 31,939 acres (12,926 ha.). — an average annual labor expenditure of about 30,000 man-days.

4. *Wastage.* Timber harvesting and utilization are still not integrated to the point of best efficiency. One operator is interested in sawlogs, and that is all he

Every aspect of timber production is included in the TVA project. There are, for example, sawmill schools, such as that shown above, where sawmill operators are helped to produce more useful timber with less waste and higher profits.

harvests : another buys only stave bolts, pulpwood, or veneer logs : too few make a real effort to harvest all of the products from a given stand of timber simultaneously. As a result wood is wasted and harvesting costs are higher than they might otherwise be.

The same is true of utilization. There are not enough wood-using centers where the whole range of forest products can be manufactured. The industry is scattered widely and in most cases it is uneconomical to concentrate waste products for further processing. In addition, almost 70 percent of the circular saw mills in the Tennessee Valley are marginal operations. They operate only part time and account for only 20 percent of the lumber production. Their operators are usually in some other business with sawmilling as a sideline. Yet these mills compete for stumpage, produce a large volume of waste, and in times of equipment shortages use material that should go to the 30 percent of the mills that produce 80 percent of the lumber.

Attitude of Industry toward Conservation

Until recently the owners and operators of forest products industries have been little interested in forest conservation and development. Only a very small percentage of the forest land in the Valley was owned by the industries that use wood as a raw material, which may account for their lack of interest ; or it may be because there has never been a real shortage of wood. Sawlogs are smaller than they once were, and lower in quality, but few industries have had to shut down for lack of raw material.

Sawmill operators in particular hold a key position in any forest development program. It is they who harvest the timber ; they, even more than the landowner, can determine cutting practices ; they can cut only high-quality timber and thus degrade a timber stand, or they can improve stand quality and productive capacity. The timber available today is the result of cutting trees before they are mature and of cutting the best and leaving the worst.

The trend now is away from this type of exploitation. Sawmill operators are coming to realize that they will profit by the same kind of management practices that are of benefit to the landowner or timber grower. The landowner is interested in growing the most timber and the best timber on a continuous basis. If the sawmill operator is interested in perpetuating his business and increasing the value of his products, his interests and those of the landowner are identical. These, too, are the interests that best serve public welfare.

More and more manufacturers of wood products are buying forest land and are managing it so that their supply of raw material will be assured. The larger industries are more progressive in this respect than the smaller ones, but the latter too are becoming concerned over dwindling raw material supplies.

TVA Approach

There are several ways of promoting forest conservation and development. All fall into four broad classifications : acquisition, subsidy, regulation, and education.

Public ownership (acquisition) has long been a part of federal policy in the United States. Today the people of the United States own 180 million acres (73 million ha.) of forest land, which is administered by the U. S. Forest Service. Some of the states have followde the lead of the federal government and have acquirde some 20 million acres (8 million ha.) of state forests.

Subsidy takes the form of forest tree seedlings distributed to landowners free or at a price that covers

Direct contact between technicians and forest landowners at all levels is an integral part of the way TVA is tackling its forest problems. Above, a group of neighbors help a farmer plant an eroded area on his farm. Reforestation is the responsibility of the man who owns the land, and so is the proper utilization of the timber he grows thereon. Below, a forest management demonstration is in progress... its aim in this instance is to teach landowners the principles of sustained-yield timber production. As in the sawmill demonstration illustrated on page 149, *the speaker has an obviously keen and interested audience.*

only part of the production cost. Federal aid to the states for fire control is another example. More recently government payments have been made to landowners who adopt certain approved conservation practices. Free service to landowners by public foresters is another form of subsidy.

Regulatory measures have necessarily been invoked by the federal and state governments in the interest of fire protection. Several states have enacted laws that regulate forestry practices on private land. Bills proposing similar federal legislation have been introduced in Congress several times, but have never yet become law.

The educational approach to forest development, especially the use of educational methods to persuade forest landowners to adopt good forestry practices, has long been used in the United States but never fully developed. Under this approach, activities are designed to enlist the support of all citizens, and the active participation of those directly concerned with timber growing or processing. Full collaboration is developed between woodland owners, timber operators, forest industries, and the public agencies involved, with the recognition that people in all walks of life must do the things necessary to develop and utilize forest resources wisely. This is the type of forestry program under way in the Tennessee Valley.

Reforestation

TVA operates two forest tree nurseries with a combined capacity of about 50 million seedlings a year. One is in the eastern part of Tennessee, the other in northern Alabama. The policy of the state forestry agencies that provide forest planting stock to landowners is to charge for seedlings. The price is not very high — $2.50 to $3.00 a thousand — but usually the people whose lands are most in need of reforestation are the least able to pay for seedlings. TVA therefore decided to provide seedlings without charge to any landowner who would agree to plant them properly and protect them against fire and grazing. Such public investment is justified by increased watershed protection and future timber production.

In each of the seven Tennessee Valley states the state forester is the recognized forestry leader. He is responsible for the reforestation project. He or his representative approves all applications for trees, those from farmers having been first approved by a county agent (representative of the state agricultural extension service). Thus an agriculturalist helps landowners to decide which farm lands need to be reforested. On non-farm lands a forester helps them with the decision.

Each year TVA foresters make an appraisal of the success of planting within some major geographic area of the Valley. The last one was in northern Alabama. During the 1949-50 planting season, landowners in the 15 Valley counties of Alabama made application for 2,121,850 seedlings. A statistical sample of these plantings in the fall of 1950 showed that 99 percent of all seedlings had been planted and that 88 percent were alive and growing. All but about 5 percent were planted on soil well suited to the species involved ; 92 percent were adequately protected from grazing. Earlier surveys in other parts of the Valley showed similar success.

Fire Control

TVA's major contribution in the field of fire control has been in the form of co-operative demonstrations with the state forestry agencies. Most of these involve financial as well as technical assistance. Some run one or two years, some as many as five years. One now operating in the 15 Valley counties of North Carolina will serve as an example. The object here was to achieve adequate protection of 1.6 million acres (648,000 ha.) of private forest land within a five-year period. TVA's financial contribution amounted to about 15 percent of the total cost. The project began in 1947 and will continue until 30 June 1952.

Major emphasis is on prevention and the training of fire control personnel. Activities are all based on annual work plans prepared jointly by TVA and State foresters. The fire situation was carefully analyzed and prevention activities are aimed squarely at major fire causes. For the five years prior to 1947 an average of 450 fires occurred in the area each year. They burned about 50,000 acres (20,000 ha.) — three percent of all forest lands, each fire destroying an average of more than 100 acres (40 ha.). During the four years of the project the average annual burn has been less than one-fourth of one percent and the area of the average fire has been reduced from 100 to 10 acres (40 to 4 ha.). The number of fires per hundred thousand acres (40,000 ha.) of forest has dropped from 26 to 17.

This and other similar projects have proved that the fire problem can be solved with adequate financing and planning. They also prove that a much greater proportion of the fire control funds must be spent on prevention. Too often the job of putting out fires takes all the money and leaves nothing for prevention. The fire control organization should always be on the defensive.

Management

In an attempt to encourage landowners to adopt sustained-yield timber management, in 1942 TVA started a forest management demonstration program in the Valley. This is also a co-operative project, set up jointly with agricultural extension agencies for farm woodlands and with state forestry organizations for other forest lands. Today there are 285 of these management demonstrations operating throughout the Valley. They cover nearly half a million acres (202,000 ha.) and include all kinds of ownerships, timber types, and topographic conditions. In each case the co-operating public agencies help the landowner inventory his forest land and prepare a plan of operation that will ensure continuous yields and maximum watershed protection. For example, a large coal company in southwest Virginia adopted a timber management plan in 1948. On their 18,000 acres (7,285 ha.) of forest land they are proving that timber growing is good business, in 1950 they cut 900,000 board feet (4,077 m^3) selectively and sawed it into lumber on their own sawmill. All trees to be culled on 150 acres (61 ha.) were girdled to release young growing stock. Timber on another 400 acres (162 ha.) was marked, and cutting is now under way. Over 200,000 trees have been planted on mined-out areas and other open land. Two cities,

one in North Carolina and one in Tennessee, have set up demonstrations on their municipal watersheds. Both are interested in water, recreation, and wildlife in addition to timber, and both have realized substantial incomes from timber sales without in any way harming the other resources. A lumber company in western Tennessee had just about cut itself out of business in 1943, so that company officials had the choice of liquidating their dwindling timber resources and going out of business, or of adjusting operations in order to obtain a sustained yield. They chose the latter course even though it meant additional cash outlays for fire control, strict control over the timber cut, and radical changes in manufacturing practices. In five years they had cut fire losses from an average of eight percent of the total area to less than one-half of one percent. They had increased their holdings from 49,000 to 75,800 acres (20,000 to 30,676 ha.) and the number of men employed increased from 80 to 130 ; their annual payroll doubled. In 1943 they dealt almost entirely in pine boards. Now they specialize in converting hardwoods into small dimension items. Their lands are becoming more productive each year.

Other demonstrations on farms, state lands, college campuses, etc., are all doing their part to convince landowners that timber growing can be a profitable business. County agents, helping to set up demonstrations on farm woodlands, learn something about forest management in the process and are able to assist other farmers. A few high schools have school forests, and vocational agriculture instructors in the public schools are beginning to teach farm forestry. Sawmill operators, once hesitant about buying timber marked for cutting by the landowner, are now beginning to see the advantages of selective harvesting.

Utilization

Perhaps the greatest utilization need in the Tennessee Valley today is a profitable use for low-grade hardwoods — the timber left by previous loggers because it had no commercial value. It has little value by present standards and yet it occupies valuable growing space. The problem is how to get it out of the woods at a profit to the owner.

TVA has investigated two possibilities : laminated lumber and wood molasses. The first involved development of a continuous glue press that would assemble small-size wood slats into a three-ply board, 12 in. (30 cm.) wide and continuous in length. Such a press was developed and tested in a pilot plant operation. The product proved very satisfactory but the press did not operate as efficiently as was expected. A new one has been designed and private industry is now being encouraged to take up where TVA left off and develop the process commercially.

Some 50 tons (45 m. tons) of molasses were hydrolyzed from hardwood waste in pilot plant operations during the last two years. This project, carried out in co-operation with the Forest Products Laboratory of the U. S. Forest Service, is designed to further the knowledge of wood hydrolysis. Prior research in the United States has dealt primarily with coniferous species. The TVA tests involve hardwoods, both round wood and mill waste. The molasses, containing about 50 percent sugar, is being tested as a livestock feed supplement.

To encourage the use of treated wood by farmers and others, TVA inaugurated a regional fence post preservation project in co-operation with six state colleges and held timber treating demonstrations throughout the Valley. The research project was aimed at testing simple treating methods as applied to the common wood species of the region. The demonstration program was to encourage the establishment of small treating plants and the more general use of treated timber. So far the colleges have treated over 11,000 fence posts (26 species) with pentachlorophenol and copper naphthenate. These posts have all been set in the ground and are examined annually. Mobile treating equipment was developed and 56 treating demonstrations have been witnessed by more than 12,000 people.

TABLE I. — PUBLIC FOREST IN THE TENNESSEE VALLEY COUNTIES[1]

	Acres	*Ha.*
Federal		
Forest Service	2 137 410	865 010
National Park Service	459 390	185 915
Tennessee Valley Authority	323 480	130 915
Department of the Army	70 800	28 653
Fish & Wildlife Service	44 010	17 811
Atomic Energy Commission	30 600	12 384
War Assets Administration	17 400	70 042
Bureau of Land Management	10 430	4 221
Farm Credit Administration	5 700	2 307
Soil Conservation Service	3 350	1 356
Veterans Administration	310	125
Agricultural Research Administration	100	40
Total	3 102 980	1 255 776
State		
State Forests	98 190	39 737
Wildlife Areas	60 700	24 565
State Parks	36 970	14 962
Defense Installations	24 300	9 834
School Lands	14 110	5 710
Other	15 230	6 164
Total	249 500	100 973
County		
School Lands	3 190	1 291
County Farms	2 180	882
County Forests	160	65
Total	5 530	2 238
Municipal		
Municipal Watersheds	52 130	21 097
Municipal Parks	160	65
Total	52 290	21 162
GRAND TOTAL	3 410 300	1 380 148

[1] Includes all tracts of 100 acres (40 ha.) or more.

As a result, 21 small commercial and co-operative treating plants are now in operation. Prior to the demonstration program there were no such plants in the Valley. In connection with this project, TVA developed two portable post peeling machines, one of which is capable of peeling over 90 pine posts per hour. A pilot treating plant was also set up to solve technical problems and provide information on treating cost.

As mentioned earlier, about 30 percent of the circular saw mills in the Tennessee Valley produce 70 percent

In forestry, as in all other branches of land utilization, education is regarded as of essential importance. Here a school 4-H club runs a fire damage demonstration plot, which is being given its annual burning. Landowners as well as the students themselves can share the results of practical educational schemes such as this, typical of many such TVA activities.

TABLE 2. — FOREST PRODUCTS INDUSTRIES - TENNESSEE VALLEY COUNTIES

Major Groups	Number of Establishments								
	Alabama	Georgia	Kentucky	Mississippi	N. Carolina	Tennessee	Virginia	Total
Sawmills	897	386	152	193	593	2 334	520	5 075
Planing Mills	119	45	7	17	52	238	36	514
Woodworking Shops	50	14	28	4	84	132	22	334
Concentration Yards	18	5	9	15	8	106	6	167
Furniture Plants	3	3	1	3	3	57	9	79
Cooperage and Cooperage Stock Mills	11	3	8	3	—	23	1	49
Handle and Handle Blank Mills	4	2	1	6	—	29	5	47
Shuttle Block Mills	—	1	1	—	19	21	1	43
Basket, Box, Crate and Pallet Plants	10	2	2	—	1	12	2	29
Special Dimension Mills	2	—	2	—	4	12	1	21
Tanning Extract Plants	—	—	—	—	7	5	1	[1] 13
Pencil Plants	—	—	—	—	—	6	—	6
Wood Turning Plants	—	—	—	—	1	3	—	4
Paper and Pulp Mills	—	—	—	—	1	1	1	3
All Others	14	5	6	2	17	80	31	155
TOTAL	1 128	466	217	243	790	3 059	636	6 539

Sawmills enumerated in 1948 by Bureau of the Census; other plants reported by Division of Forestry Relations personnel as of July 1951.
[1] Three plants also manufacture paper and pulp.

of all the lumber manufactured in the region. To encourage greater efficiency in the operation of these mills, TVA made a study of a representative sample. Here are some of the findings: only about 15 percent of the mills are operated on sound management principles. They saw too many small logs — logs that yield lumber worth less than the cost of producing it. Many mills are under-powered and lack such necessary equipment as edgers, spare saws, and log handling devices. They lose an average of two hours a day from shutdowns, most of which could be avoided, and operate only 120 days a year, less than half the potential number. They earn a margin of only 10 percent for profit and risk when they could earn twice as much. These facts were analyzed and translated into practical recommendations for improved sawmill management. They were distributed widely at sawmill schools and conferences throughout the Valley. A companion study on the production of logs is now in progress.

Conclusion

The activities mentioned above are representative of what is being done in the forestry phase of the Tennessee Valley resource development program. There are others, equally important, but space does not permit describing them - forest resource and industry inventories, management investigations, soil-water-forest relationship studies, improvement and testing of black walnut and other nut bearing trees. These and others are all part of the unified, co-operative program being carried on in the Valley.

Much has been accomplished; much more remains to be accomplished. However, TVA is steadily proving that an informed mankind can work in harmonious partnership with nature. The fight against forest depletion has given way to a crusade for forest development.

Forest Fire Control

This Report deals with a Study Tour arranged in the United States under FAO's Expanded Technical Assistance Program; the report has been compiled by staff members of FAO Forestry Division.

Serious forest fires can only be prevented and controlled by men who are thoroughly trained to carry out well planned procedures and methods of attack. This is the essential element in any successful fire control program. The details of the training, the kinds of equipment used, and the operational procedures must be adapted to local conditions in each country.

These were the main lessons learned by the 34 foresters from 22 nations [1] who participated in a Forest Fire Control Training Program in the United States of America from 5 September to 12 October 1951. Designed to permit the study of American methods of forest fire prevention and control, this project was sponsored jointly by FAO and the Economic Co-operation Administration of the United States of America, and the program was arranged by the United States Forest Service in conjunction with the Office of Foreign Agricultural Relations of the Department of Agriculture, under the supervision of Major Evan W. Kelley as Project Manager.

The Chief of the U.S. Forest Service generously made available the personnel of the Fire Control Division and Research Branch at headquarters in Washington D.C., and the full facilities of Region 1 (Idaho, Montana, eastern Washington) at Missoula, Montana; of Region 5 (California) at San Francisco; and Region 8 (Southern States) at Atlanta, Georgia. The State Foresters of Idaho, Washington, California, Mississippi, Alabama and Georgia participated with their staffs in the program, together with a welcome number of private organizations and business concerns.

The visitors first assembled in Washington D.C. to be greeted by the Honorable Charles F. Brannan, Secretary of Agriculture, and to be briefed by representatives of FAO, E.C.A. and O.F.A.R. A mutual exchange of information then took place on the forest fire problems of the various countries represented, and this greatly helped the host foresters of the U.S. Forest Service in arranging, during the tour, for special emphasis to be given to ideas, procedures, and equipment most readily adaptable to the need of the respective countries.

Field-work in the North-west

On the first stage of the field work, the whole group travelled by plane to Spokane, Washington, where the regional foresters described the local forest conditions, fire problems and control methods. They showed the visitors the Supply Depot and explained how it functioned to provide supplies and equipment for fire control throughout the Region. That the training of the men who operate the Depot impressed the visitors is shown in the final report:

"As a result of experience gained from thousands of fires over a period of years, all tools and equipment stocked are well suited to the work. Particular mention must be made of the 25-men standard fire outfit package, a complete kit of tools, bedding and mess equipment for an average-sized fire-fighting crew; the 5 to 15-men Back Pack outfit, which can be segregated for 5-men, 10-men or 15-men emergency crews; and the 1-man smokechaser Pack, which provides tools and 1-man 1-day rations for the first individual dispatched to small fires..... It was particularly educative to see how all these stores, with others, are kept and maintained in orderly manner at the Spokane Depot (and at Ranger Stations), and how they could be dispatched with lightning speed and without error by a mere handful of highly trained men. The principle is generally acceptable, and the methods used should present no difficulties if adapted intelligently to local circumstances."

At the District Headquarters of the Forest Service of the State of Washington, near Spokane, the group saw how the personnel operated to combat fires on state-owned and privately-owned land, and how they co-operate with the Federal Forest Service, particularly in regard to detection and communication activities. Next the party proceeded to northern Idaho to spend a profitable week in the Kaniksu and Coeur d'Alene National Forests. Amongst much else of interest, the members saw the fire research work of the Northern Rocky Mountain Forest Experiment Station where H.T. Gisborne's pioneering in firedanger forecasting began; logging operations; slash disposal work; forest road construction projects, and private sawmills. The co-operative work of the U.S. Forest Service with the State of Idaho and the Western Pine Association was demonstrated.

The scene then shifted to the State of Montana. A visit was made to a Forest Service tree nursery which produced planting stock for burned-over and cut-over forest land. At Remount the group saw how smokejumpers are trained, and watched demonstrations of men parachuting from airplanes to an actual fire and of equipment being dropped to them — and then join-

[1] Argentina, Australia, Brazil, Canada, Chile, France, Germany, Greece, Guatemala, Honduras, India, Italy, Mexico, Netherlands, New Zealand, Norway, Pakistan, Philippines, Thailand, Turkey, United Kingdom, Venezuela.

ed in a hot lunch which was dropped at their feet. Three of the party went with one of the planes on a routine flight to drop equipment to a fire-crew on a forest fire in an inaccessible part of the Payette National Forest in Idaho.

The visitors saw how pack-mules are transported, loaded, and taken out on trails into otherwise inaccessible country, and how bull-dozers build fire-lines in difficult terrain where there is much fallen timber. The entire group had an opportunity to see how radio and telephone communications are handled by the U.S. Forest Service, and film-shows on fire-fighting supplemented the field demonstrations.

At Missoula the group discussed questions of interest with individual staff officers of the Regional Office and the Experiment Station, and saw how aerial mapping is used in fire-control work. The visitors were particularly impressed with the way in which the fire-prevention campaign is conducted through all possible media of publicity and education — newspapers, magazines, radio, teaching materials for schools, and the showing of Forest Service motion pictures. Especially striking was the cartoon of "Smokey Bear" and his admonition, "Only you can prevent forest fires," which appears on billboards, on road signs, in shop windows, and is heard on the radio. Incidentally, an over-eager black bear, trapped during the stay at Remount, showed the visitors when it was released that bears can be quite appealing.

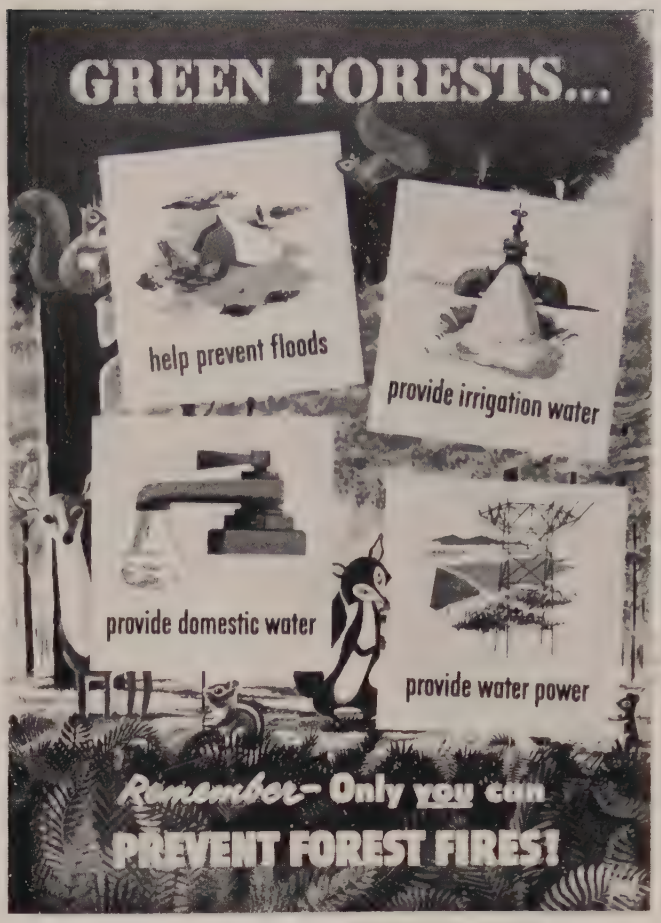
California — The Golden State

The group now divided into two sections, one party going to California and the other heading for the southern states via Chicago.

The California party visited the Shasta National Forest, where it saw the tragic smoking ruins of the recently controlled Shasta fire. This scene gave point to all that was learned of the development of the Federal and State fire-control organization, and to the importance of the fire-weather forecasting carried out in collaboration with the U.S. Weather Bureau. The group proceeded down the Sacramento River Canyon, and had an opportunity of hearing the story of fire prevention along the Southern Pacific Railroad right-of-way and along U.S. Highway No. 99.

At the Shasta Dam it learned from the U.S. Reclamation Service how the impounded waters, which originated on watersheds in the National Forests, would be used for irrigation purposes in the production of farm crops. In this connection there is a close link-up between the forest influence research and fire research of the California Forest Experiment Station. In Southern California, watershed protection and management are especially important, and high water values justify very intensive fire control programs by the Federal, State, and county governments. These programs fit together with each other and with those of several private organizations. The San Dimas Field Station provided an excellent example of the complexity of water-forest-fire relations.

The party witnessed demonstrations of specially developed equipment, operated by men carefully trained for the job. They saw logging and sawmill operations and fire prevention activities of several private lumber companies. In the Plumas National Forest they



Education and admonition combined in this attractive fire-prevention poster

saw how slash disposal is conducted; how fire prevention and control is handled in connection with sales of National Forest timber to private operators; and how fire planning is based on research findings.

They visited Divisional Headquarters of the California State Forester's Organization, and at San Francisco spent some time with the Regional Office staff. The strategy and tactics used in several recent serious fires were explained on maps and on the ground, to give the visitors a clear idea of how a highly organized set-up functions. In the Cleveland National Forest, demonstrations of helicopter operations were given to show the part these machines play in fire control.

The Southern States

The Southern party divided its time between three National Forests: the Mississippi, characterized by longleaf-slash pine (*Pinus palustris - P. caribaea*) flatwoods conditions; the Alabama, where there are hill types of southern pine mixed with hardwoods; and the Chattahoochee in Georgia, typical of the mixed hardwood Appalachian Mountain forests. The visitors were interested to learn that the large number of fires, mostly in fast-burning grass fuel types, required a very different form of attack from that used in the western states. The easy accessibility of the open forest has led to the development of tractor-plows which can be quickly transported on trucks to a fire area, to plow a mineral soil line around the burning area. The fuel between the line and the fire-face is burned out by

Latest among the forest fire-fighters' weapons is the helicopter. Their very nature makes these aircraft ideal for many jobs in fire prevention, especially reconnaissance and communication. This photograph shows one in action at a big fire at Wheeler Springs, Los Padres National Forest, in California.

torches or fusees. This method has succeeded in holding down the average size of fires and uses less manpower than former hand-line construction methods. Slight modifications in plows have been made to meet the variations in topographic conditions in various parts of the South.

The group had an opportunity to see the functioning of the detection systems, the dispatching of equipment and men, and the actual suppression operations. They were impressed, here as in the West, by the close co-operation between the Federal, State, and private industry organizations in prevention and control. The excellent conditions for forest growth in the southern states and the increasing development of forest industries have resulted in a keen appreciation of the value of fire control by many lumber companies, pulp and paper companies, and naval store operators.

At the Harrison Experimental Forest of the Southern Forest Experiment Station the group saw the results of research into the use of " prescribed burning " for silvicultural and hazard reduction purposes, and in fire danger forecasting. The results of such research have been effectively put to use in the National Forests to improve the efficiency of the fire control organizations.

Final discussions in Washington D.C.

Back in Washington D.C., both groups met together again. Talks were given by C.A. Gustaffson, Chief of Fire Control, and A.A. Brown, Chief of Fire Research of the U.S. Forest Service, summarizing the work that had been seen during the whole tour.

A general report was drawn up to serve as an aide-memoire for the participants. Briefly sketching the history of forest fires in the United States and the efforts made at prevention and control, this report says :

" It is interesting to note that the problems of the various countries, as described by the participants, varied from U.S. experience not so much in kind as in relative importance. In North America the feeling that forests were an obstacle to farming resulted in the use of fire to clear land, and this, when done carelessly, caused tremendous damage to valuable forests. As in many other countries, burning for grazing purposes still persists in parts of the U.S.A , and this points to the continuing need for prevention measures, particularly all forms of educational efforts, and especially adequate legislation. "

Many of the participants in the program had stressed the difficulties imposed on a fire control organization

by the inaccessibility of the forested areas to be guarded. The greatest need in some countries was for detection methods and improved communications and transportation systems.

Undoubtedly, the main problem affecting almost all countries was inadequate financial support to the forest service for fire prevention and control, more specifically to enable the technical personnel to apply and adapt known control methods.

Several tropical countries were represented on the tour, and it was considered that the problems mentioned above applied equally, if not more forcibly, to them as in the case of countries of the temperate regions. The outstanding difficulty in tropical countries was perhaps shifting cultivation, called by different names in different parts of the world but producing the same disastrous results. It is a similar, and more vicious, form of clearing for farming purposes to be seen in the U.S.A. The results in soil erosion and water loss, and the enslavement of the population to an itinerant life of continual poverty, serve to drive home the importance of education and demonstration, of legislation, and of adequate appropriations to support the work of the forest services in controlling these practices as a first step in the planned use of forest resources for the well-being of each country's people.

The report points out that " The lesson... is that forest fire education ought to be based on the development of the personal interests of the local residents..... It needs the persistent and continued action of men devoted to forest protection. "

With regard to legislation, the report suggested that consideration be given to a compilation and analysis of all forest fire legislation as a guide to governments wishing to formulate or modify forest fire laws. Special attention should be given to joint federal and state programs, perhaps along the lines of the U.S. Clarke McNary Act.

The value of research was generally recognized and the report says, " In general it is believed that where organized forest fire protection is established, an adequate proportion of the expenditure involved should be allocated to research. "

The principal emphasis of the report is on Presuppression and Suppression. Under the former considerable space is given to planning a fire control system, the principles and techniques to provide for detection, communications, transportation, location and placement of fire fighters, type and placement of equipment, system of dispatching equipment, its development and specifications, the use of aircraft, and the selection and training of personnel. Suppression is discussed under the sub-headings of operation and management of the control organization, with special regard to supervision and lines of authority, operation methods in detection and communications, and the organization for fighting large fires.

Finally, the report lists certain recommendations, amongst which appears the following passage :

" It is felt that the incentive to interchange of knowledge and experience between countries that this tour has given should be fostered continually by FAO. This could best be done by FAO serving, as far as practicable, as a center of co-ordination and dissemination of information on all developments in the sphere of forest fire management, research, policy and equipment..... In the meantime, the participants wish to express their gratitude and to congratulate the United States Forest Service, ECA and FAO for the joint efforts that made this tour possible. "

So ended a most instructive tour, providing an excellent example of the kind of useful project that can be developed through the Expanded Technical Assistance Program of the United Nations.

UNESCO Coupons

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has requested UNASYLVA to make known to readers certain facts concerning " UNESCO Coupons. " These coupons were originally designed to facilitate, for institutions and individuals in UNESCO member states, the acquisition of books, periodical and other similar publications from other countries, despite shortages of foreign exchange and despite foreign exchange restrictions. Following the success of the Book Coupon plan, the coupons have been extended also to facilitate the acquisition of educational, scientific and cultural films, filmstrips and raw film stock ; and the acquisition of scientific material, laboratory equipment, etc.

UNESCO coupons make possible the importation of these items outside normal currency regulations, *and in many cases with special facilities also for exemptions from customs duties.*

Persons desiring more detailed information may secure special leaflets entitled " The UNESCO Book Coupon ", " The UNESCO Film Coupon ", and " The UNESCO Coupon for Scientific Materials ", as well as the latest " Information Circular on the Coupon Scheme ", by writing to the following address :

UNESCO Coupon Office,
19, Avenue Kleber,
Paris 16, France.

Some idea of the destruction wrought in pine forests by the pine beetles discussed in this article may be gathered from these photographs. Above is a general view of part of an area.... actually totalling over 4000 acres... of Pinus leiophylla killed by beetles near Amecameca. All too evident is the fact that loss extends not only to the actual and potential timber resources, but also to the land itself, stripped of vegetation and ready for the eroding influences of the climate. The photograph below gives a closer view of another area, near San Rafael, little more than a year after infestation had started.... a fact which makes the importance of controlling so rapid a pest more than usually important.

Pine Bark Beetles of Central Mexico

by J. P. Perry, Jr.,
Administrative Assistant, Rockefeller Foundation Agricultural Program in Mexico

Available records show that the death of pine timber over extensive areas in Central Mexico was first attributed to bark beetles in 1903. In that year Dr. Sylvio J. Bonansea was appointed by the Government of Mexico to make investigations in the States of Mexico, Morelos and Michoacán, where the inhabitants were concerned over the dying pine forests.

Dr. Bonansea found that bark beetles were the primary cause of the trouble. His report *La Plaga de Ocotes* which was not published until 1921, described the aspects of the dead trees and the insects and their work. He also included many observations on the general features of the infestation and suggested various control measures.

Dr. Bonansea sent specimens of the insects collected in these areas to Dr. A. D. Hopkins of the Bureau of Entomology, U. S. Department of Agriculture. From this material Hopkins described *Dendroctonus mexicanus* Hopk. and *Ips bonanseai* Hopk. as new species. In his publication entitled The *Genus Dendroctonus*, he states that *Dendroctonus mexicanus* "evidently attacks *Pinus teocotl* Schl. et Cham., *P. leiophylla* Sch. et Cham., and *P. ayacahuite* Ehr." Another species, *Dendroctonus parallelocollis* Hopk., is listed as occurring in Michoacán but specific host trees are not mentioned. A 1936 publication by Donald De Leon lists, with descriptions and host references, a number of the bark beetle species that attack pines in Mexico. In all the literature that is available there is very little information about the life history and habits of the insects, their host relationships or the causes of the aggressive outbreaks that are characteristic of the infestations.

At the present time a highly epidemic infestation of bark beetles is in progress in stands of *Pinus leiophylla* around the valley of Mexico, similar in all its characteristics to the outbreaks of half a century ago which were described by Prof. Bonansea. [1] Recent observations by the author indicate that widespread bark beetle outbreaks have occurred at periodic intervals in Central Mexico over a very long period and that their effects have at times accelerated the transition from forest cover to unwise agricultural use of the land.

The purpose of this article is to put on record the results of studies made by the author during the years 1949 and 1950 in Central Mexico. In the course of intermittent field trips from Mexico City, it has been possible to acquire an understanding of the habits of three species of bark beetles, their interrelationships, the manner in which they attack and kill living trees, and the extent to which they may destroy certain stands of pine.

Areas and character of pine stands affected by recent epidemics

The infested areas studied by the author are located near the towns of Tlalmanalco, San Rafael, and Amecameca in the State of Mexico. Dr. Sylvio Bonansea refers to large infestations of *D. mexicanus* in this same locality and undoubtedly there have been intermittent epidemics in the area as a whole during the past 45 years. Judging from the size of the present beetle-killed areas, the timber losses during these years in this locality must have been tremendous.

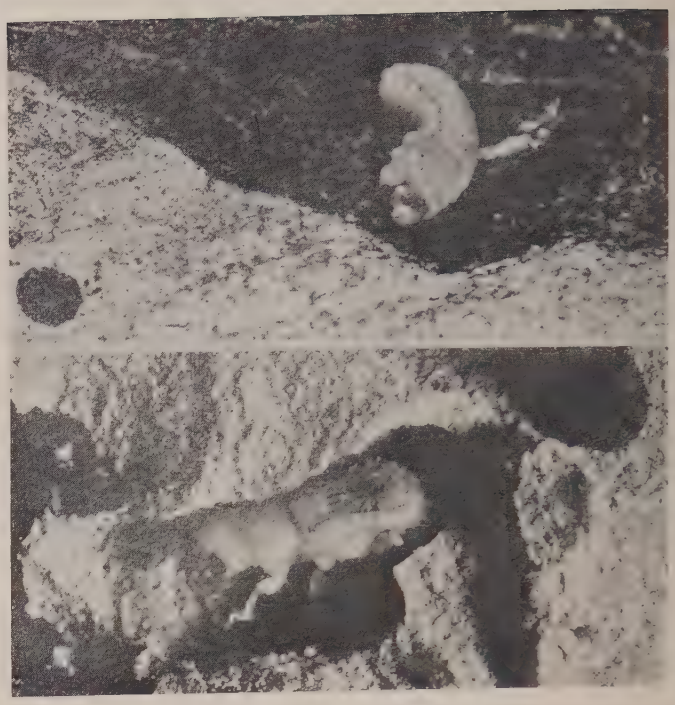
Information obtained from the local population dates the beginning of the present epidemic at about 1947 and the "peones" questioned were unanimous in locating the first outbreak as occurring on the slopes of a small mountain a few miles west of the town of Amecameca. Ing. Humberto Ortega reports that he observed the first indications of increasing bark beetle activity in this area in 1945. The writer has observed the final stages of this kill and found that the forest was composed of an even-staged stand of *Pinus leiophylla* [2] averaging 10 in. (25 cm.) d.b.h. with an understory of scattered scrub oak (*Quercus* sp.). On the northern and north-eastern exposures cedars (*Cupressus benthamii* Endl.) also formed a small part of the overstory. With the exception of a few trees on the south-western fringe, this pine forest had been completely wiped out by 1949 leaving only scrub oak and cedar. The area of this kill is estimated to be 4,000 acres (1,600 ha.). *D. mexicanus* [3] apparently spread in 1949 from this infested area across the surrounding countryside, attacking many of the small isolated pine stands in the vicinity of Tlalmanalco. It was in a number of these stands that the writer was able to follow in considerable detail the progress and development of the insect.

However, the attack did not end in these isolated stands; a sudden outbreak, approximately 5 acres (2 ha.) in extent, was first observed in 1950 in the foothills of the Sierra Nevada range, near the town of San Rafael, approximately 5 miles (8 km.) from Amecameca. The beetle is now spreading up the

[1] An FAO entomologist, J. M. Miller, is now working in Mexico under the Expanded Technical Assistance Program, and two other FAO experts, G. Becker and F. Schwerdtfeger, have been investigating similar bark beetle epidemics in Guatemala.

[2] Specimens of the trees mentioned in this article are deposited in the author's herbarium.

[3] Duplicate specimens of the insects mentioned in this article are deposited in the U. S. National Museum.



Left: male Dendroctonus mexicanus working the pitch flow in order to keep tunnel and entrance open. Above: full grown larva and young adult in cells in outer bark of Pinus leiophylla.

pine forested slopes of this mountain range and only a rough estimate can be made of the number of acres of trees that will be destroyed. The predominant pine on the lower slopes is *Pinus leiophylla* with an intermingling of *P. montezumae* and *P. montezumae var. macrocarpa*. Martinez. At higher elevations the two latter pines become more evident and fir (*Abies religiosa*) begins to appear and increases in numbers with the increase in elevation. As the forest gradually changes with increasing preight from predominantly *P. leiophylla* to *P. montezumae var. macrocarpa* - *A. religiosa*, the epidemic apparently loses force and vigor and gradually dies out.

Life history of Dendroctonus mexicanus

The bark beetle primarly responsible for the extensive kills in these areas is *Dendroctonus mexicanus*. The habits of this species have not been fully describnd in previous publications, so are covered in some detail. In 1906 Hopkins described the adults of this species as averaging 3.8 mm. in length and closely resembling *D. frontalis* though somewhat smaller. The adults attack the living tree in force but each individual entrance in the bark represents the work of a pair of beetles, generally with the female actually excavating the tunnel entrance. From the entrance the tunnel is excavated vertically up the trunk for a short distance, allowing the pitch to flow freely from the entrance hole. During this stage the activities of the male are limited to pushing out the resin as it flows into the tunnel. When the resin flow ceases, the tunnel is curved sharply and extended down and around the stem in a winding, elongated "S" shaped pattern. The writer has recorded tunnel length of 13 to 16 in (33-41 cm.) with the adults still actively elongating the tunnel and laying eggs.

Egg laying proceeds as follows: the female first excavates a small niche in the tunnel wall, then the egg is deposited in this niche and frass packed round it. The eggs are placed in niches alternately along both sides of the tunnel. It was found from a number of egg counts that the female deposits an average of 6 eggs per inch (2.5 cm.) of tunnel. The male, working approximately two in. (5 cm.) behind the female, packs the tunnel solidly with frass. As the eggs hatch, the minute larvae mine outward into the phloem at right angles to the main tunnel. As they increase in size, they gradually feed toward the outer, dry bark, attaining their maximum size as they reach the outer bark. When they enter the bark, all feeding ceases and a cell is constructed wherein the changes from larvae to pupae to adult take place. The new adults mine directly outward from the pupal cell through the bark and emerge completely developed and capable of immediately initiating a new attack on living pines.

The following table gives data on the average number of days required for the development of *D. mexicanus* in *Pinus leiophylla*:

TABLE 1. — NUMBER OF DAYS REQUIRED FOR DEVELOPMENT FROM EGG TO NEW ADULT, *D mexicanus* IN *Pinus leiophylla*

Area No.*	No. Trees in which Brood Development was followed	Average No. Days Egg to Adult
4	36	79.9
5	2	76.0
1	19	78.6
3	57	79.4

* The area numbers are selected stands representing slightly different conditions in elevation and exposure.

Above : close-up of inner bark showing detail of egg galleries and early larval burrows of Dendroctonus mexicanus. Right: characteristic form of gallery made by adult beetles in Pinus leiophylla.

The biotic potential. It can be seen from the data on the developmental period that it is possible to obtain four generations of insects per year. This gives the insect a tremendous biotic potential — particularly since no true period of dormancy was observed during its life cycle. Even during the coldest months of the year — November, December and January — temperatures during the middle of the day were high enough to insure some feeding and development of larvae. The writer has also recorded numerous successful attacks as occurring during these coldest months.

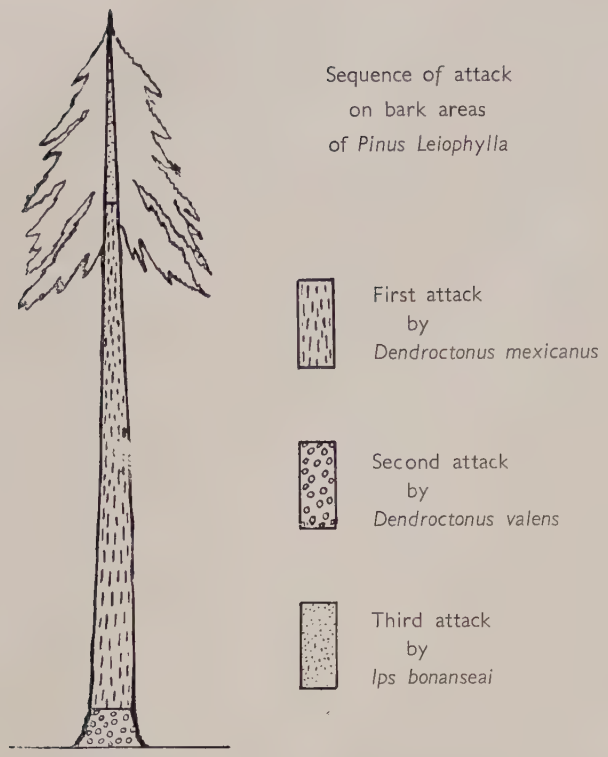
Time was not available in these studies to determine whether any percentage of the parent adults re-emerge, after constructing egg-galleries in the first tree attacked, to start new attacks in other trees. This habit has been studied in a closely related species in California, *D. brevicomis*, where it was found that at times as high as 50 percent of the parent adults re-emerge to start new attacks. However, observations of the egg-galleries constructed by *D. mexicanus* indicate that most of the parent adults die near the ends of these galleries, and re-emergence of the parent adults apparently is not an important factor in the biotic potential of this bark beetle.

Dendroctonus valens. After the initial attack by *D. mexicanus*, the infested pine is then invaded by *D. valens*. This insect is well known throughout the United States, and its habits have been recorded in bulletins of the U. S. Department of Agriculture[4].

It is interesting to note, however, that there is apparently a minimum diameter limit under which it does not attack *P. leiophylla* in Central Mexico. Numerous records by the author place this minimum diameter limit at approximately 6 in. (15 cm.) outside the bark, measured at the ground line. There is also apparently no true period of dormancy in its life cycle in this area, since attacks were commonly found occurring during all months of the year.

Ips bonanseai. Following the successful invasion of the tree by *D. mexicanus* and *D. valens*, there occurs another invasion by a third scolytid, *Ips bonanseai* Hopk. The adult insect as described by Hopkins averages 3.3 mm. in length, is elongated, cylindrical and of a dark reddish brown color. The declivity of the elytra is excavated and each side is armed with four short acute teeth. This species only invades the tree after the attacks of *D. mexicanus* have completely stopped the flow of resin, and then only the upper part of the stem and larger branches are attacked. The entrance hole is bored through the bark and phloem to the xylem. A nuptial chamber is excavated in the phloem and from this chamber three or four winding egg-galleries are constructed. The females deposit their eggs in niches spaced alternately along the sides of the galleries. Frass is packed around each egg in its niche but the egg-galleries and nuptial chamber are kept open at all times. As the eggs hatch, the larvae feed outward from the galleries into the phloem. As the larvae mature, a pupal cell is constructed in the phloem and the pupal period is passed in this cell. The new adults work their way through the old frass that was once phloem tissue, to the old galleries and emerge through the entrance and ventilation holes. No effort was made to determine the average length of time required to complete the life cycle of this insect. However, it was noted that infestations oc-

[4] Hopkins, A. D., *The Genus Dendroctonus*, U.S.D.A. Bulletin No. 83, 1909.
Beal, J. A., and Massey, C. L., *Bark Beetles and Ambrosia Beetles*, School of Forestry, Duke University, Durban, N. Carolina, Bulletin 10, 1945.
Keen, F. P., *Insect Enemies of Western Forests*, U.S.D.A. Miscellaneous publication No. 273, 1938.



curred during the coldest months of the year which suggests the absence of a dormancy period in the life cycle.

Significance of the sequence of attack in individual trees

There is thus a sequence of invasions of the living tree by these three species of scolytids. The primary attack by *D. mexicanus* is always made on the stem of the tree, generally at a height of 18 to 20 ft. (5-6m.) from the ground if the bole is fairly clean. In smaller tees or trees with many low branches, the attack iss grenerally started in the area where the first branche occur. From this point the infestation extends down the stem to a distance approximately 18 in. (46 cm.) from the ground and at the same time up the stem to a top diameter of 4 in. (10 cm.). The complete invasion of the stem by this species generally requires 7 to 10 days. At this point *D. valens* successfully invades the tree from the ground line up the stem for a distance of approximately 18 in. (46 cm.)

Following the primary and secondary invasions, *Ips bonanseai* attacks the top portion of the tree. In every instance the attack was observed to occur only when the foliage of the pine had started to wilt or approximately 20 days after the invasion of the stem by *D. mexicanus*, when the latter had reached the minute larval stage. The *Ips* infestation extended down the stem to a diameter of 6 in. (15 cm.) and was also found in the bases of the larger branches. In no instance was there observed a reversal of this sequence of attack. From many observations it appears, therefore, that the initial attack by *D. mexicanus* is absolutely necessary for subsequent successful invasions by *D. valens* and *Ips bonanseai*.

Group attacks

Group behavior of *D. mexicanus* in attacking stands of *Pinus leiophylla* appears to be quite similar to that of other species of *Dendroctonus* attacking coniferous stands in the western U.S.A. The spread of a number of infestations in small isolated stands was followed in considerable detail and in every instance the pattern was the same. At first a small group of trees was heavily attacked, then the adjoining trees were rapidly invaded until a center of infestation including 10 to 20 or more trees was established. The surrounding trees were generally attacked by the new beetles emerging from the first group, the infestation slowly spreading through the stand in ever widening bands. A characteristic feature of these small killed areas is the few isolated surviving trees left on the fringes.

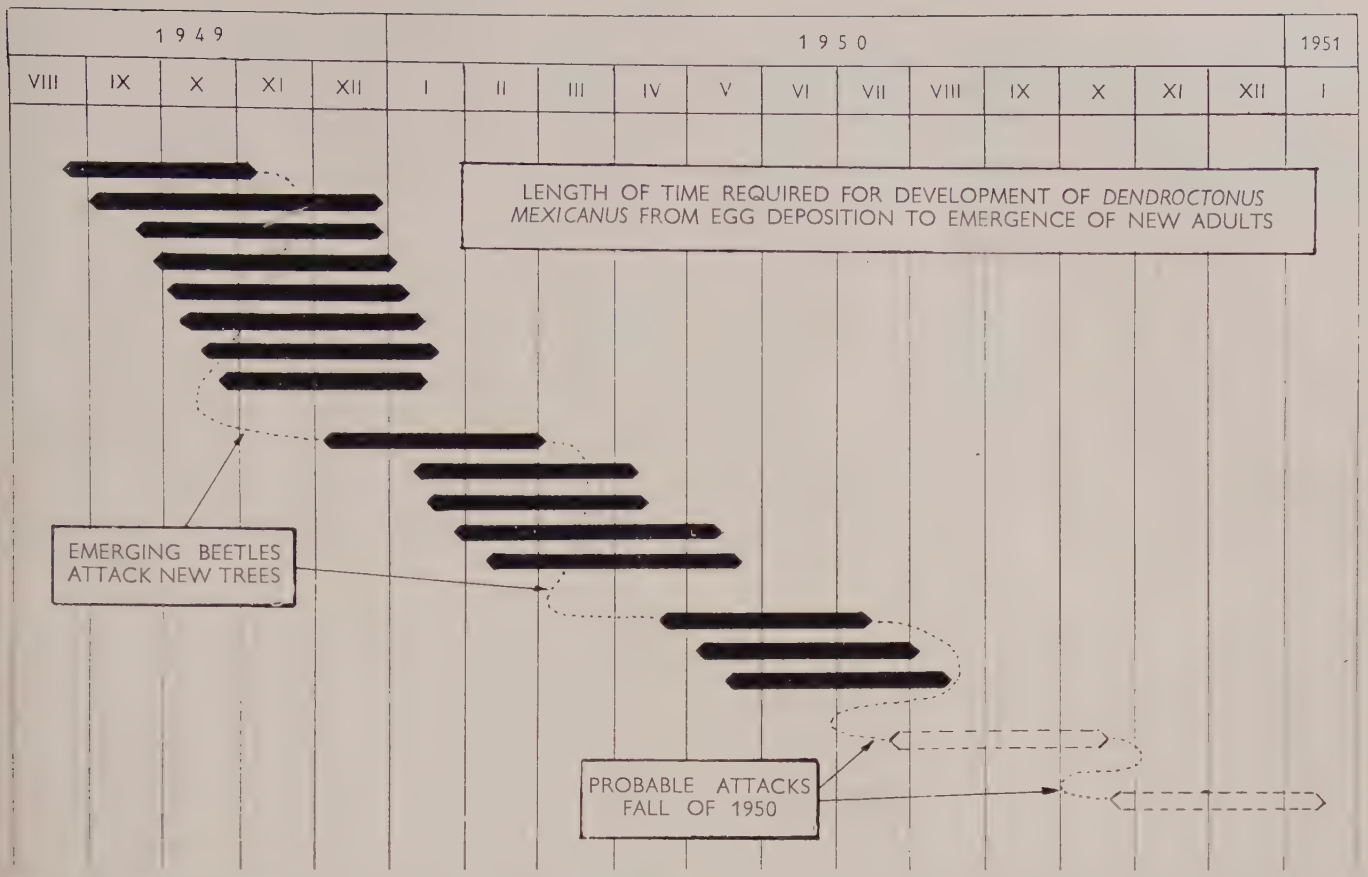
In other instances, particularly in large stands of pine, group infestations were observed on a much larger scale. A number of these larger infestations covered from 5 to 10 or more acres (2-4 ha.) and thousands of pine trees were attacked simultaneously. As the first generation brood emerged, they immediately attacked the surrounding living trees and in a comparatively short period of time a forest covering several hundred acres was completely infested. In some cases groups of large size appeared suddenly in areas where no previous attacks had occurred. It is believed that these large spontaneous infestations are the result of mass flights of insects from an infested area where the number of living trees is no longer sufficient to afford hosts for the tremendous population of emerging beetles. The large group outbreak in 1950 near San Rafael is believed to have occurred in this manner when the emerging beetles in the infested forest near Amecameca no longer found enough living host trees nearby. This mass flight covered a distance of approximately 5 miles (8 km.), but on smaller stands where the population pressure never becomes so tremendous, movement of the newly emerged beetles is generally limited to the nearest living pine trees. As long as there are sufficient living pines in the larger infestation centers, the insects apparently merely spread out from the original group kill. This spread of the beetles through a pine forest can be easily followed by the changes that occur in the color of the foliage of the infested pines.

Table 2 indicates the length of time required for the most important color changes :

TABLE 2

Color of Foliage and State of Tree	Approx. no. days from date of attack	Average Development of *Dendroctonus mexicanus*
Fading	30	Small to medium larvae in phloem
Brown	60	Pupae in outer bark
Red	90	Adults emerging
Black (needles gone)	120	Emergence complete
Fruiting bodies of fungus *Polyporus volvatus* on stem	150	
Destruction of wood by fungi proceeding rapidly. Tree now fallen to ground	300	

Thus complete destruction of a pine tree killed by *D. mexicanus* occurs in less than one year. The



author has photographed patches of wheat growing among the stumps of pines that had been killed by *D. mexicanus* for less than a year.

Comparative resistance of Pinus leiophylla and P. montezumae var. macrocarpa

In the areas that were studied it was noted that *P. leiophylla* was quickly overcome by the attacks of *D. mexicanus* and that in the heavy epidemic centers, few trees survived.

The only other pines on which the attack was observed were determined by Prof. Martinez as *Pinus montezumae* and *P. montezumae var. macrocarpa*. In the latter variety, which is often present in mixed stands with *P. leiophylla*, the beetles apparently encountered difficulties, and many trees were found which had survived strong attacks. Very few attacks have been found in *P. montezumae*.

Differences between *P. leiophylla* and *P. montezumae var. macrocarpa* in their resistance to *D. mexicanus* were noted in the character and abundance of the pitch tubes, the success of the beetles in producing progeny and the ability of epidemic infestations to sustain their momentum.

Differences in Character of Pitch Tubes. In *P. leiophylla* the entrance holes of the beetles were marked by a copious flow of the oleoresins. As a rule, well defined pitch tubes do not form, but the pitch tends to drip down the bark surface forming long, glistening streamers. In *P. montezumae var. macrocarpa* the entrance holes are more numerous and the resins harden, quickly forming distinct turret-like pitch tubes. Many of the attacking adults are trapped by rapid drying of the pitch and die in the pitch tube without gaining entrance to the tree. This difference in the character of the pitch tubes is due to differences between the chemical components of the oleoresins produced by the two species of pines. A report by Dr. N. T. Mirov shows that the oleoresin from *P. montezumae* is composed almost exclusively of alpha-pine dextrose, while that from *P. leiophylla* contains only 90 percent alpha-pine dextrose, 8 percent of delta-3-carene dextrose and 1 percent of sesquiterpine dextrose.

Differences in brood potentials of D. mexicanus. Some trees of *Pinus montezumae var. macrocarpa* are killed by *D. mexicanus*, but it was noted that in these cases there was a heavier attack of beetles per unit area of bark than in *P. leiophylla*. A comparison of the number of entrance holes, each of which represents the attack of a pair of parent beetles, and of the exit holes which represent the emergence of their progeny, will illustrate this difference. Table 3 is based on counts of the entrance and exit holes in bark areas, selected at random upon two killed trees representing both species of pine.

TABLE 3. — COMPARISON OF NUMBER OF ENTRANCE AND EXIT HOLES OF *D. mexicanus* IN *P. leiophylla* AND *P. montezumae var. macrocarpa*

	P. leiophylla		*P. montezumae var. macrocarpa*	
	Sq. ft.	m²	Sq. ft.	m²
Total bark surface counted .	6.8	0.6	5.5	0.5
Average No. of entrance holes per sq. ft. (m²)	8.0	0.7	16.8	1.6
Average No. of exit holes per sq. ft. (m²)	104.0	9.7	39.0	3.6

This table indicates that more than twice as many beetles attacked the bark surface of *P. montezumae*

The two upper photographs show the pitch flow produced by Dendroctonus mexicanus attacks on, left, Pinus leiophylla and right, P. montezumal var. macrocarpa. Below : left, are adult Ips bonanseai (x 3 approx.) in partially constructed egg galleries ; and right, egg gallery and adult (x 5) of Dendroctonus valens.

var. macrocarpa than attacked *P. leiophylla*, while more than two and a half times as many progeny emerged from *P. leiophylla* as from *var. macrocarpa*. In fact, if we allow two parent adults to each entrance hole, the number of beetles attacking per square foot in *var. macrocarpa* is 33.6 (362 per m^2), the number emerging 39 (420 per m^2), which permits only a negligible increase per generation. When mortality of the new beetles during the flight period and attack on new trees is taken into account, a decrease of beetle population is to be expected.

Effect of host species upon populations of D. mexicanus. — The results shown in Table 3 are entirely in line with field observations. In pure or nearly pure even-aged stands of *P. leiophylla*, *D. mexicanus* becomes epidemic and spreads rapidly until practically all of the stand has been destroyed. Epidemics are less aggressive where *P. montezumae var. macrocarpa* makes up an appreciable percentage of the stand, and where a high percent of this tree species is found, no epidemics have yet been observed.

Control of D. Mexicanus

Control experiments were not attempted in these studies as time was available only for collecting biological and ecological data. However, some information on both natural and artificial control of the beetle is available and will therefore be included here.

The sequence of the attacks indicates that *Ips* and *D. valens* cannot maintain epidemic infestations except in a secondary capacity to *D. mexicanus*. For this reason control efforts can be concentrated on *D. mexicanus* to prevent the virulence and spread of epidemics like those now in progress.

Biological control

Birds. The feeding of woodpeckers on broods of *Dendroctonus* beetles in the bark of infested trees is very common in the pine forests of the United States, and at times is considered to be an important factor in the natural control of the beetles. Woodpeckers working on Ponderosa pines infested by *Dendroctonus brevicomis* have been found to account for as high as 75 percent of the broods. However, no woodpecker work has been found in connection with the infestations of *D. mexicanus*. This may very well be due to the great scarcity of the birds, which through lack of protection seem to be approaching extermination in these areas.

On the other hand Dr. Bonansea mentioned that the reduction of predatory and parasitic insect populations by birds was one of the reasons for the epidemic bark beetle outbreaks. There is no evidence, however, that birds have played any such role in recent outbreaks.

Insect Predators. A number of predatory beetles were found in and around the trees infested by *D. mexicanus*. Most of these are the same species as those found in connection with *D. brevicomis* and are undoubtedly important in the biological control of the former species.

Enoclerus sphegens F. (F.), *Thanasimus nigriventris* and *Themnochila virascens*, all determined by E. A. Chapin.

Cymatodera sp. near Morosa (Lec.) determined by O. L. Cartwright.

Adults of the above species were observed feeding on the adults of *D. mexicanus* and the larval forms were found in the bark with the larval broods of the bark beetle. Although these predators are present in numbers, their control effect has obviously been insufficient to check the rapid increase of the bark beetle in recent epidemics.

Insect Parasites. Adults of small chalcids were found in rearings of *D. mexicanus* from infested bark collected from *P. leiophylla*. These were determined by Dr. B. D. Burks of the U. S. National Museum as *Pachyceras sp.* and *Tomicobia sp.* The nature of the rearings did not definitely establish these hymenopterous insects as parasites of *D. mexicanus*, but it is probable that they are because of the known parasitic habits of many species belonging to this group. A very small number of the adult chalcids were reared, however, and their relative scarcity indicates that they are not an important factor in the biological control of the beetle.

Direct Control

The methods used for the direct control of *D. brevicomis* should be equally effective with *D. mexicanus*. These consist of burning the infested bark to destroy the insects, or of spraying the bark with penetrative toxic oils until it is well saturated. In either case felling the tree before treatment of the bark is of advantage, and where burning is used, peeling the bark from the log is desirable.

Ing. Humberto Ortega, Chief of the Department of Forest Protection of the Government of Mexico, reports that direct control work was carried on in 1950 against the infestation in parts of the *Unidad Forestal* of San Rafael. Where the land was privately owned, it was possible to get the owners to provide the labor to cut, limb and peel the infested trees. The forester of the *Unidad* marked the trees to be cut and supervised the burning of the infested limbs and tops. The owners were permitted to sell the wood which paid for costs of the operation. Several large infestation centers were treated in this way.

When these same areas were examined one year later, no new attacks were found around the areas that had been treated. These results indicate that eradication work on *D. mexicanus* has a definite local control effect and that good results are possible if the work is throughly done.

In the "ejidos" [5] which contain the communal land of the *Unidad Forestal*, the dead trees are given to the communal owners or "ejidatarios" under the law, and it has not been possible to raise the funds to carry on direct control work. Because of this, infestations have run unchecked in the forested areas of ejidal lands. The *Unidad Forestal*, however, maintains a forest nursery and is replanting some of the devasted areas.

Control through forest management

Regulated cutting and management of pine stands may offer the best solution for prevention of outbreaks of *D. mexicanus*. In stands of *Pinus leiophylla* that had been killed by the recent epidemics, growth of the older trees had been rapid for the first 35 to 40 years; but beyond this age there was a very abrupt slowing down of growth as shown by suppression of the annual rings. It was during this period of suppressed growth that the present bark beetle epidemics occurred. This evidence suggests that in the even-aged stands of *P. leiophylla* which have passed the period of rapid growth, clear cutting at about the time when growth begins to stagnate, would partially eliminate the hazard of beetle epidemics and allow for full utilization of the wood before it deteriorates. Replanting of these clear cut areas with more resistant species, such as *P. montezumae var. macrocarpa*, should offer a sound method of silvicultural control of the beetle in those areas where sustained production of pine is desired.

[5] Lands which have been restored or granted to agricultural communities under the land reform initiated in 1915.

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Commodity Report

Sawn Softwood

The year 1951 was characterized for many countries by a speeding-up of special defense programs, a replenishing of stocks and, in some cases, the stock-piling of strategic materials.

All this was planned to come about without serious interference with civilian requirements. But in a number of countries it occasioned control measures which, directly or indirectly, affected the production, consumption, trade and prices of sawn softwood.

The extent of controls varied widely. In the United States they embraced different phases of merchandizing and consumption, including prices, but in Canada they were kept to a minimum, although a governmental Department of Defense Production with relatively extensive powers was established.

The strong demand for sawn softwood that resulted from the Korean situation at the turn of the year 1950/51 led to the high prices which were maintained for most of 1951. There were slight declines in prices in North America in the summer, and an obvious reluctance on the part of a number of importers to accept prices quoted by North European exporters ; but it was evident that only a profound change in the demand-supply pattern, resulting from a combination of high production, completion of stockpiling and a slowing down of consumption, would temporarily ease the situation. A shortage of sawn softwood has become axiomatic in the postwar years, but at the end of 1951 there appeared to be some indications that appetite was for the moment lessening.

By early December 1951 it seemed that the sawn softwood production for the whole year in the United States would be comparatively close to the level of 1950, and in Canada and Europe would possibly exceed that of the previous year. There were no signs of a serious slackening of consumption in North America, but those European importing countries which already decreased their purchases of sawn softwood, in 1951 still did not show any particular eagerness to re-enter business on a large scale. At the same time, the strongly improved supply position in the United Kingdom was creating a new situation in the European sawnwood trade.

Because of the large stocks apparently possessed by that country and the quantities purchased in 1951 which would carry over to the 1952 shipping season, the United Kingdom's total new import requirements for 1952 were estimated at only 650,000 standards. Importers would reportedly be allowed to make contracts for the first 350,000 standards at the beginning of 1952, a quantity representing only 25 percent of the country's total purchases in 1951 ; purchase of the remaining 300,000 standards would be permitted only later in the year.

For this reason it appeared that the opening of the 1952 season in Europe would be more subdued than a year before, and that prices would be the main topic of discussion.

Several factors tended to bolster the existing price level toward the end of 1951, the most important being the rise in log prices due to keen competition with pulpmills and even pitprop producers. In the State Forest auctions in Finland and Sweden during October and November, average prices were 60 to 70 percent above the 1950 levels, but in December there were some abrupt fluctuations. The importance of these cannot at present be clearly judged, but more recently a certain lack of trust in the maintenance of the level of sawnwood prices seems to have developed in the exporting countries. In many quarters the belief is held that a trend towards a buyer's market might cause exporting countries to decrease fellings in the present logging season and reduce their output of sawn softwood in 1952.

The timber trade can display remarkable flexibility and the efforts of trade circles will probably obviate any serious situation in the coming year. Since Canada can, if necessary, always come to the assistance of Europe and many other parts of the world, it will be interesting to watch future financial policies concerning dollar allocations.

Europe

Rising prices made importers in most European countries adopt a cautious attitude in concluding contracts for 1951. At the same time, the restrictive measures taken in the building industries of some of the importing countries, as a result of the scarcity of raw materials and high prices, together with increasing difficulties in financing timber purchases, had already foreshadowed a possible decline in the general level of civilian consumption of sawn softwood.

The increased stocks in most of the importing countries also contributed to the weaker buying, as there was no immediate need for replenishment. The buying by these countries for 1951 shipments practically came to an end in March 1951, after which month only insignificant purchases were made. The United Kingdom, however, and to some extent Western Germany, continued buying throughout the spring until the summer of 1951, at which time there were the first signs of hesitation to accept whatever was offered. The purchases effected by the United Kingdom during this period could be considered as covering requirements for the whole year and even for a part of 1952 ; they made it possible to envisage the raising of stocks of sawn softwood to a high level and the creation of a stronger position for buying for 1952.

By the summer of 1951 most of the exporting countries had disposed of practically all their sawn softwood

available for export during the year, and the small quantities still on hand were mostly goods of inferior quality or unpopular dimensions, which did not attract importers, particularly at the prices asked.

From that time on the European sawn softwood market was practically dormant. Both importing and exporting countries were ready to wait and see what future developments would bring about. The new roundwood prices for to winter 1951/52 and for 1952, on which prices of sawlogs for the coming season would depend, were observed not without a certain anxiety by both parties. Importers seemed to be determined to resist the rising prices of sawn softwood, and exporters on their side watched the continuous rise of roundwood prices, caused mainly by competition with pulpwood and pitprops, with a feeling of uncertainty. There were in many cases indications that the prices which were expected to be paid for sawlogs already corresponded to the top prices paid for sawn softwood during the 1951 season. In the main exporting countries the small sawmills, which were not integrated with other industries such as pulp, paper or wallboard industries, seemed to be particularly anxious, as they had no means of making up eventual losses on sales of sawn softwood by obtaining higher prices for other products.

Consumption

Total consumption of sawn softwood in Europe increased in 1950 as a result of high industrial activity, and at the beginning of 1951 appeared to be continuing on the same level. Civilian consumption showed some signs of declining, due to governmental restrictive measures and high prices. This falling-off, particularly in house building, seems to have been compensated by the increasing needs for industrial and military purposes, particularly packaging, and therefore total 1951 consumption may prove to have been high.

Production

A big boost was given to felling operations in most countries in the autumn of 1950, when it seemed apparent that the rise in timber prices would continue. While previously only sawlogs and pulpwood had been competing, the increased demand for pitprops and also for fuelwood brought in a new competitive element, which in countries where there was a shortage of forest labor may have had some adverse effect on the output of sawlogs, the targets set for which were not always reached. Fellings in most European countries however increased, and the total production of sawlogs was somewhat higher than in previous years.

The increase in sawn softwood production in the main exporting countries in the first six months of 1951, due to the extremely favorable market conditions, was further stepped up during the second half of the year, and available figures suggest that the total 1951 production in Europe will exceed the 1950 output, despite decreases in several countries. The changes in production appear in Table I.

Stocks

The heavy demand for sawn softwood during 1950 led to a substantial reduction in the stocks of most of the exporting countries, despite increased production. Simultaneously, stocks in most of the importing countries markedly increased, and were in general higher than a year before. This was chiefly a result of purchasing above normal requirements, in the expectation of even higher prices later on. Stocks in the United Kingdom showed a contrary development ; they declined steadily and by the end of 1950 were only about half the quantity of a year before.

TABLE I. PRODUCTION OF SAWN SOFTWOOD
(Thousands of standards)

	1951	1950	
	January-June	January-June	January-December
Total for Europe [1, 2]	4 400 0	4 200 0	8 180 0
of which :			
Austria	376 7	286.8	567.3
Belgium	25.7	18.2	31.0
Denmark	*a* 30 0	*a* 30.0	*a* 51.3
Finland	551.0	508.0	874 8
France	*b* 299.6	299.6	*b* 620 6
Germany (Fed. Rep.)	836.8	793.2	1 679.3
Italy	..	..	222.1
Norway	..	..	*b,c* 343.9
Portugal	..	..	*a* 128 0
Sweden	..	..	1 199 7
Switzerland	47.1	79 2	184.9
Turkey	*a* 26.5	35.5	79.3
United Kingdom	*a* 23.7	*a* 27.9	144 9
Yugoslavia	172.1	234.0	415 6

[1] Partialy estimated
[2] Excluding the U.S.S.R.
Source : ECE and FAO Statistics
a estimated figures
b preliminary figures
c including sawn hardwood

During the first half of 1951 the position of the United Kingdom showed a marked improvement, and was expected to improve still further as a result of arrivals of large quantities purchased for 1951. Other importing countries also strengthened their holdings by the arrival of large quantities of goods lying over from 1950.

Although little data were available on stocks in exporting countries at the end of 1951, it appeared unlikely that they could be as large as at the end of 1950, assuming that shipments of 1951 sales proceeded normally.

Imports

Imports of sawn softwood in 1951 substantially exceeded those for 1950, mainly due to the increase in the imports of the United Kingdom which more than compensated for the small declines in other European countries. The falling-off in the imports of Belgium, Denmark and France appeared due to the large stocks at the beginning of the season and the weakening in building activity.

While the bulk of 1951 imports into continental Europe came from the northern European countries, these exporters provided less than in 1950. Imports from eastern and central Europe, on the other hand, showed a marked rise ; of particular interest was the resumption of large imports from Poland and Czechoslovakia into other continental countries, particularly into Belgium and the Netherlands. During 1950 such imports had mostly been insignificant.

United Kingdom imports from Canada and the northern countries increased, and in June 1951 Canadian

supplies were already about five times those of the corresponding 1950 period. Imports from eastern European countries, and Yugoslavia, substantially declined; those from Poland, which were smaller in 1950 than in 1949, were expected to cease completely, and those from the U.S.S.R. and Czechoslovakia remained considerably below the previous year's.

Changes in sawn softwood imports by some European countries to the middle of 1951 appear in Table II.

TABLE II. EUROPEAN SAWN SOFTWOOD IMPORTS
(Thousands of standards)

Importing countries	1951	1950	
	January-June	January-June	January-December
Belgium	49.0	56.4	151.1
Denmark	57.7	58.2	229.2
France	15.6	26.8	58.9
Germany (Fed. Rep.)	51.4	47.0	151.5
Greece	34.2	34.0	73.6
Ireland	27.5	32.1	76.1
Italy	101.5	92.0	231.7
Netherlands	177.1	144.7	430.1
Switzerland	9.9	4.3	12 0
United Kingdom	562.2	226 3	770.6
Other West European countries	19.1	30.2	41.9
TOTAL	1 105.2	752.0	2 220.0

Source: ECE and FAO statistics.

Exports

The increase in sawn softwood exports from most of the exporting countries continued from 1950 into 1951. The market conditions remained on the whole favorable, and the total 1951 exports may therefore reach and even exceed immediate prewar exports.

TABLE III. EUROPEAN SAWN SOFTWOOD EXPORTS
(Thousands of standards)

Exporting countries	1951	1950	
	January-June	January-June	January-December
Austria	272.9	229.1	475.5
Finland	225.5	187.4	657.0
France	107.4	49.5	130.5
Germany (Fed. Rep.)	18.4	21.6	47.3
Norway	8.2	9.0	16.9
Sweden	277.6	278.4	747.2
Yugoslavia	66.3	65.1	157.3
Other West European countries	24.2	13.2	16.5
TOTAL	1 000.5	853.3	2 250.0

Source: ECE and FAO statistics.

The falling-off in continental demand for northern sawn softwood did not affect total sales and exports, as the United Kingdom offered a practically unlimited market until the summer of 1951, and overseas markets — mainly South America, South Africa and Australia — were also strong, and sales to these areas had in most cases exceeded the 1950 figures.

In short, the northern exporting countries increased their exports to the United Kingdom and overseas, whereas exports from the central and eastern European countries were directed more to continental Europe.

Available figures for European exports (excluding the Russian bloc) during 1950 and the first half of 1951 are shown in Table III.

Prices

Despite the strong reaction of importers, prices continued to rise throughout the second quarter of the year, although less steeply than in the first. This can, however, be considered as partly due to the traditional increase of prices for the quantities remaining after the bulk has been disposed of, and should therefore not be considered as indicative of the general price level.

The question of prices has been widely discussed in the trade press all over the continent, but the final consumer reaction still remains to be seen. It was feared, in most importing countries, that an increase in retail prices caused by the arrival of more expensive goods might have undesirable effects on future consumption. Such increases in retail prices would reflect not only the higher export prices, but also the rises in freight rates and handling costs, all passed on to the consumer.

Table IV gives average f.o.b. prices of Swedish sawn softwood to demonstrate the price development from January 1949 to August 1951, and the slowing down of the price rise from April 1951 onwards.

TABLE IV. AVERAGE PRICES OF SWEDI SAWN SOFTWOOD
(Swedish crowns per standard, f.o.b. Härnösand district)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
2 ½inch × 7inch *redwood u/s battens*												
1949	620	620	620	618	613	613	613	613	613	613	649	649
1950	652	671	700	715	750	750	760	770	775	830	1 035	1 050
1951	1 075	1 110	1 180	1 220	1 230	1 235	1 250	1 260	—	—	—	—
2 ½inch × 7inch *whitewood u/s battens*												
1949	613	613	613	608	598	598	598	598	598	598	625	625
1950	650	660	675	680	685	685	690	705	710	765	975	1 005
1951	1 045	1 095	1 130	1 170	1 190	1 200	1 200	1 205	—	—	—	
2 ½inch × 7inch *red and whitewood fifths*												
1949	593	593	593	578	547	547	547	547	547	547	573	573
1950	580	605	627	640	670	670	675	680	700	730	930	955
1951	995	1 040	1 090	1 140	1 150	1 170	1 175	1 180		—	—	—

Source: Kommersiella Meddelanden, Kommerskollegium, Stockholm.

NORTH AMERICA

CANADA

Consumption

Residential construction in Canada began to show a downward trend about June 1951. Statistics for unit completions to the end of June were still ahead of the 1950 figures, but houses started totalled 38,500 compared with 42,150 for the corresponding period of the previous year. To the end of August new units started had fallen off about 16 percent compared with 1950. The number of immigrants during the first half of the year, almost 80,000, already exceeded the total immigration figure for 1950 (73,700), and the housing situation was becoming tight. In autumn 1951, the Canadian government relaxed some restrictions, giving special emphasis to the construction of houses urgently needed in the defense program, but it was believed that only somewhat over 85,000 homes would be provided in 1951, against 91,000 in 1950.

As a contrast to residential building, there was an increased rate of heavy construction, made up in large part of defense production contracts. The cumulative figure for construction during the first eight months of 1951 was about Can. $1,693 million, as compared with about $882 million in 1950. The trend continued in the autumn.

Production

Output of sawn softwood in 1950 reached a very high level, according to preliminary estimates 3.2 million standards as against 2.9 million standards in 1949, due largely to demand from the United States Production during the first quarter of 1951 rose to almost 30 percent above the first three months of 1950.

The production of all lumber to the end of July 1951 was estimated at about 18 percent above the figure for the same period of 1950. In June 1951 the output of sawn softwood was 15 percent and in July 5.5 percent higher than in the corresponding months a year earlier the largest increases being in British Columbia.

Later in the summer, an exceptional drought in British Columbia, causing a very grave fire risk, compelled the authorities to impose forest closures. Felling in the affected areas was brought to a standstill, and operations discontinued in a large number of sawmills. The ban, lifted only after the first autumn rains in September, resulted in heavy losses in logging and sawmilling operations.

Exports

Shipments of sawn softwood to the United States reached an exceptionally large volume in 1950, totalling 1.443 million standards, a rise of about 114 percent. over the corresponding figure for 1949. While exports to Europe, primarily to the United Kingdom, dropped considerably, the total exports of 1.85 million standards, were about 42 percent above the 1949 figure.

During the first three months of 1951, shipments continued to maintain a high level, attaining a total volume of 389,000 standards, as against 290,000 standards a year earlier. However, there was a change in the pattern of trade, inasmuch as shipments to the United States slightly decreased and those to the United Kingdom were greatly increased.

By the end of the first six months of 1951 exports of all lumber were nearly 13 percent, and a month later 6.5 percent, above the corresponding figures for a year earlier.

Prices

Prices for sawnwood in Canada were affected by fluctuations on the United States market and by changes in domestic demand. Certain anxiety was felt in the fall of 1951 about the cutting back of building programs in many centers. In the eastern provinces of Nova Scotia and New Brunswick, stumpage costs have shown an upward trend in the last few years, thus keeping costs of lumber at a high level and forcing many operators to do business at a relatively small margin of profit.

After the lifting of the ban on logging operations in British Columbia in September 1951, log prices were firm for all species. Hemlock was reported to be selling at an unprecedented high level, owing to the heavy demand from pulp and paper plants. Toward the middle of October, however, the domestic market for pulpwood slackened and had less affect on prices paid by sawmills.

United States of America

Consumption

Construction activity during the whole year 1950 was very high, and remained so through the first three quarters of 1951, particularly in the industrial and government sectors. In the first half of 1951, housing construction activity did not catch up the previous year's level; new houses begun numbered 583,500 compared with 705,700 a year earlier. Starts of new nonfarm dwelling units rose again slightly in September, as credit restrictions were eased.

The demand for lumber, relatively strong at the beginning of 1951, decreased in the second quarter as a result of government credit restrictions and market regulations. In May and June the softening of the market was reflected in the decrease of shipments and new orders, while stocks at mills were building up. Military requirements for sawnwood had not yet taken up the slack in demand. In the third quarter the relaxation of credit restrictions on lower cost construction was believed to encourage the demand for sawnwood, and, in addition, there were expectations of possible large purchases later in the fall for military purposes.

Production

According to estimates, total lumber output in the United States for 1950 was 36,722 million board feet the highest since 1929; of this, sawn softwood accounted for 29,160 million board feet, corresponding to 14,725,800 standards, an increase of almost 10 percent over 1949.

According to the National Lumber Manufacturers' Association, production at reporting mills during 44 weeks of 1951 was much the same as a year earlier Output of the most important softwood item, Douglas fir, was 104 percent, production of Western pine 94 percent, of Southern pine 95 percent, and of the less significant Northern pine 131 percent of the corresponding 1950 total.

Toward the beginning of November 1951, the balance of unfilled orders and gross stocks for the main sawn softwood items were, on the whole, as satisfactory as a year earlier.

Trade

Exports of sawn softwood in 1950 totalled 195,200 standards compared with 254,600 in 1949. At the same time that domestic production rose as already indicated, imports from Canada exceeded the 1949 imports by more than 110 percent, and imports from sources other than Canada almost doubled.

During the first quarter of 1951 exports were more than twice as high as in January-March 1950, shipments to the United Kingdom and Latin America having increased particularly. On the other hand, imports remained roughly equal to those in 1950.

Prices

Prices had been comparatively firm after the 1950 summer upsurge. A further boom was experienced at the beginning of 1951, when it became obvious that the government was about to extend price controls. The level of ceiling prices was actually set at the highest point in January 1951. Strong demand, partially limited by freight car shortages, scarcity of logs and unfavorable weather conditions, kept prices firm until the end of the second quarter when a gradual decline in average wholesale sawnwood prices was noticed. The price drops experienced were somewhat larger than in Canada. The situation changed relatively quickly as construction activity became more lively and stocks, which had been allowed to dwindle during the period of uncertainty, had to be replenished. By October/November prices had again reached firmness.

Other regions

Brazil

Production of Paraná Pine, which had been decreasing in 1948 and 1949, showed an upward trend during 1950 and the first six months of 1951. This was partly due to a more vigorous policy by the government-controlled National Pine Institute in encouraging increased pine production and finding new export markets. During 1950 a comparatively much larger proportion of 3rd and 4th quality sawn pine lumber was exported, principally to the La Plata market, and as a result there was some concern about the home production of boxboards and the construction of simple houses used by a large percentage of the working classes in Brazil.

By October 1951, shipments to Argentina, which in 1948 and 1949 accounted for 70 to 80 percent of total exports were now below 50 percent of the total. Exports to Uruguay remained fairly constant. There had been some purchases by the United States and Australia, but the termination of the barter scheme covering Brazilian trade virtually stopped new United Kingdom purchases of Paraná Pine, as f.o.b. prices increased from £60 to £70 a standard to a level of £90 to £100 a standard at the official currency exchange rate. Total exports in 1950 were 175,000 standards.

Mexico

Production of sawn softwood, originating from the forests of the central high plateau, totalled about 1,169,000 m^3 or 250,000 standards in 1950. Exports almost exclusively to the United States, absorbed roughly one-third of the softwood timber produced in the country, mainly because transportation northwards is easier than to the domestic center of consumption, Mexico City with its surroundings, where there is a large unsatisfied demand. The government made efforts in 1951 both to limit the exploitation of the forests, and to restrict exports to the United States.

The only other big producing country in Latin America in 1950 appears to have been Honduras, which turned out about 180,000 standards.

Japan

According to reports, a major shortage of timber is developing in Japan. The continuation of overcutting, permitted over the past 25 years, could result only in the total elimination of the remaining softwood resources within a relatively short period. In recent years more than 8,000 sawmills are reported to have discontinued operation because of shortage of logs. Production in 1950 is reported as 1.738 million standards.

There is every likelihood of a lower level of production of sawn softwood in the future, as legislation is under way imposing severe restriction on fellings, to build up the depleted growing stock. At the same time the Japanese Government intends to tighten control on wood exports to conserve the country's dwindling supplies.

New Zealand

Construction of new dwelling units in New Zealand, calculated on the basis of those begun in 22 larger centers, was maintained at a relatively stable level through 1950. Activity slackened in 1951 despite the expanded house building program, and the rise in domestic production of timber.

Production of sawn softwood during the year ending 31 March 1950 was 225,000 standards, about equal to the preceding year. For the next year output reached a new high record 247,600 standards. The production of exotic timber had increased by 24 percent and that of indigenous timber by 4 percent. *Insignis* pine accounted for 35 percent of the total timber sawn. On the other hand, kauri had only a dwindling share of total output, less than one percent. The production of sawn exotic timber by State Forest sawmills reached the record level of 32 million board feet, equal to almost 19,000 standards of sawn product.

New Zealand has been exporting certain amounts of sawn softwood, practically all to Australia.

Australia

Building activity in Australia has considerably expanded during the postwar period. The monthly averages of completed new dwelling units went up from 4,038 in 1948 to 4,407 in 1949, and 5,157 in 1950, the total for 1950 being close to 62,000. In the first quarter of 1951, a drop in construction activity limited the monthly average of completed houses but this was apparently only seasonal.

In 1949/50, total domestic sawn softwood production amounted to 46,400 standards and according to early forecasts, was believed to be running at approximately an equivalent level in 1950/51.

However, imports of soft sawn wood in 1950, totalling 129,500 standards, far exceeded domestic production. While it was believed that 1950/51 imports would come close to 200,000 standards, including increased purchases from Scandinavia and further supplies from Brazil and Roumania, the Australian Government has reportedly set a construction target of 96,000 new houses per year. The timber allowance per unit being 4.5 standards, over 400,000 standards will therefore be needed for houses alone. In order to overcome the timber shortage, the government has placed a total ban on timber exports and even on inter-state trading.

European Commission on Forestry and Forest Products

The European Commission on Forestry and Forest Products held its fourth session at Rome 1-6 October 1951.

Representatives of the following 16 countries took part: Austria, Belgium, Denmark, Finland, France, Western Germany, Ireland, Italy, Norway, Netherlands, Portugal, Sweden, Switzerland, Turkey, United Kingdom and Yugoslavia. Observers attended from the Economic Commission for Europe of the United Nations, the International Labor Organization, the Organization for European Economic Co-operation, the International Union of Forest Research Organizations (IUFRO), and the International Popolar Commission.

The session was opened by the Chairman, O.J. Sangar (United Kingdom). Marcel Leloup, Director, Forestry Division, welcomed the delegates on behalf of the Director-General of FAO, who attended in person at a later session, and Gunnar Myrdal, Executive Secretary of the Economic Commission for Europe, spoke of the degree of co-operation achieved between ECE and FAO in forestry and timber and the need for even closer collaboration in future.

Adoption of Agenda

The Commission adopted the agenda drafted by the Secretariat, with the exception of the item relating to the election of the Chairman and Vice-Chairman which was deferred until the final plenary session. This was in accord with the unanimous wish of the delegates that the Chairman (O.J. Sangar, United Kingdom) and Vice-Chairman (E. Saari, Finland) should continue in office for the duration of the fourth session.

Forest Policy

The Commission considered the reports on national forest policies received from member governments in accord with the recommendations of previous sessions and which will be made public at a later date. During the discussion of these reports, delegates decided unanimously to extend a special expression of sympathy to Austria, Switzerland and neighboring countries on the loss of life and damage to property and forests suffered as a result of the snowfalls and avalanches last winter.

It was agreed that these reports permitted a much truer assessment of the forestry situation in Europe than had been possible previously. Member governments were asked to continue to report annually in the form adopted at the Third Session, but it was confirmed that, as then recommended, statements should be confined to corrections or amendments of 1951 reports, together with such additional information as related to developments or changes in forest policy during the year under review; also that statistical information normally reported to FAO and ECE in routine questionnaires should be excluded.

The main topic considered was the relation between annual fellings, allowable cut (*possibilité*) and increment. The question selected for special attention in the 1952 report was basic data relevant to forest policy, and member governments will be asked to provide, annexed to their reports, answers to the following questions:

(1) What is the most recent evaluation of annual growth? (Supply a critical assessment of this figure).

(2) (a) Is there a national figure of allowable cut (*possibilité*)?

(*b*) Is this applicable both to state (controlled) forests and to other wood resources, i.e. private forests and trees outside the forest? [Distinguish if possible between allowable cut for state (controlled) resources and others. If the figures given relate only to controlled resources, make this point clear].

(*c*) What is the present figure of allowable cut, and to what period does this relate?

(*d*) What are the details of the annual cutting plan 1947-51 and for subsequent years if a plan has been laid down?

(*e*) How are the above figures arrived at?

(*f*) What are the reasons for any differences between these figures and those for annual growth?

(*g*) What powers are there to enforce adherence to the cutting plan?

(3) What were the average annual fellings for the period 1947-51? [Supply a critical assessment of this figure. Distinguish, if possible, between fellings in state (controlled) resources and others].

(4) If the figure for average annual fellings is higher or lower than that for allowable cut, state reasons.

(5) Are the facts reported under heading (4) above, considered dangerous or not? If they are considered dangerous, what steps are being taken to remedy this situation?

Certain other subjects for special enquiry had been suggested in a paper prepared by the Secretariat. It was apparent that there existed a wide range of problems, including that of co-operation amongst small forest owners, as mentioned by the delegate of Denmark, which is to be the subject of special investigation by FAO's Forestry Division in 1952. Research activities, both governmental and private, and their financing were also considered to be of much importance, but it was agreed that consideration of this and other subjects raised should be deferred in order that member governments might not be unduly burdened with the preparation of reports. As regards research, co-operation was available with the International Union of Forest Research Organizations which had a large program already under way.

Mr. Glesinger (Deputy Director, FAO Forestry Division) described the present position as regards the Timber Trends Study which was being undertaken in collaboration with ECE. He stated that the study was designed to indicate the past and current relationship between supply and demand whilst providing such indications of probable trends as would suffice to guide forest policy. Although the study was not yet complete, he considered that the indications to date were that future demand would tend to increase, particularly in respect of pitprops and pulpwood.

Mr. de Vignaux, Chairman of the ECE Timber Committee, emphasized the urgency for the preparation of medium-term and long-term forest policies and for the completion of the study as a guide in this matter. He stressed the need for the closest collaboration between ECE and FAO in this connection.

Mr. Myrdal (Executive Secretary, ECE) described the difficulties which had been encountered, but endorsed the view that the study should be pressed vigorously to completion Mr. Leloup concurred in this view.

The Commission adopted a resolution asking that the study be pursued with the utmost vigor, and that member governments arrange

to provide such information as may be necessary to make the Study of the greatest use. It considered that any conclusions drawn at this stage must be very provisional and, in short, that the study was as yet not sufficiently advanced to form the basis of recommendations to member governments concerning forest policies. The Commission recommended that

(1) the Secretariat, in consultation with the Chairmen of the European Forestry and Forest Products Commission and the Timber Committee of ECE, decide when the Timber Trends Study is sufficiently advanced to warrant a consideration of its implications, and that,

(2) when this stage is reached, the Director-General of FAO be asked to arrange for a meeting of a small joint Working Group representing both the European Forestry and Forest Products Commission and the Timber Committee of the Economic Commission for Europe, at which the trends revealed by the study can be considered, to be followed by a joint meeting of the Commission and the Committee at which the implications for foresters and wood users of the trends revealed can be examined and, if thought necessary and desirable, appropriate recommendations to member governments made.

Seed Certification and Exchange

The Commission considered a secretariat document on Seed Certification and Exchange and examined the proposals which had been put forward. The information assembled on the existing procedures for the collection, control, and distribution of seed in various countries was of value, but it was not considered necessary to publish it at this stage although the Secretariat was instructed to continue to obtain further relevant information.

Suggestions were made as to supplementary details to be included in the Certificates of Quality and Origin approved at the Commission's last session, but it was pointed out that these were intended to cover only the minimum and that any additional information could, by arrangement between the countries concerned, be inserted in the spaces provided.

The Commission considered that the Secretariat should collaborate with the International Union of Forest Research Organizations in compiling a list of the Institutes responsible for seed control in member countries.

The consignment form prepared by the Secretariat on the instructions of the last session was considered to be of assistance and was adopted subject to an amendment to the effect that gross weight should be stated and that packages be marked "Experimental material of no commercial value."

Forestry Films

The Commission took note of a document which summarized the information obtained by the Secretariat as recommended by the last session. It recommended that FAO should continue to assemble information on newly released forestry films, in the light of the suggestions made by various delegates with regard to film titles, specifications, date of production, and terms on which films are available.

In view of the great importance of forestry documentary films for educational and propaganda purposes, the Director-General of FAO was asked to regard requests for assistance in their production as acceptable under the ETAP Program, on the condition that sub-titling in other languages was provided in order to make such films of the widest possible utility.

Soil Conservation and Torrent Control

The Commission recommended that, in view of the strong interest of foresters in matters of soil conservation, member governments should take steps to assure that forestry experts were fully represented on the European Working Group on Land and Water Utilization and Conservation.

The Director-General of FAO was asked to consult with governments concerned with a view to convening in 1952 a special meeting of technical experts on Torrent Control, at which the subject of protection from avalanches should also receive full attention.

Forestry Documentation Center

Mr. Leloup explained that the question of an international documentation center for forestry and forest products had been placed on the Agenda in order that delegates might be informed of the present position. He emphasized the importance of FAO's forestry library and of proper documentation in relation to the Expanded Technical Assistance Program.

Mr. Saari, Chairman of the joint FAO/IUFRO Bibliography Committee, referred to the report of this Committee's recent meeting in the Netherlands, and stressed the possible interpretations and wide scope of the term "documentation." Mr. Leloup, on behalf of FAO, promised that due regard would be given to Mr. Saari's observations and agreed that full use must be made of existing centers.

The Commission heard a statement from Mr. Cameron, Chief, Expanded Technical Assistance Program, Forestry Division, who pointed out that the Commission had a two-fold interest in this matter as representing countries which were not only recipients of technical assistance but were also suppliers of many experts to the Technical Assistance Program. On the suggestion of the delegate for Austria, the Commission agreed to draw the attention of the Director-General to the great importance it attached to adequate technical information as a fundamental requirement for the efficient conduct of the work of technical assistance experts. It considered that the provision of documentation, including the organization of technical reference services at FAO Headquarters in co-operation with existing forestry centers, should be an integral part of technical assistance activities.

The Commission also emphasized its view that the most important aspect of technical assistance was the creation in a recipient country of conditions which would make possible the implementation of the recommendations of FAO experts. In this connection basic documentation was necessary for the use of the national authorities. The Commission believed that this could be provided by depositing in the country, under suitable arrangements for servicing, the documentation supplied to experts, to which should be added a reasonable amount of additional material needed to complete essential requirements.

Afforestation and Reforestation

As proposed by the last session of the Commission, a special working group on afforestation and reforestation met prior to the fourth session to review the current programs of member governments.

The Commission received the report of this working group and adopted it with certain amendments.

The working party agreed that the documentation at its disposal permitted the members to obtain a general idea of the planting programs now under way and of future trends. It was not necessary to undertake a fresh comprehensive inquiry, but governments would be asked to report annually on progress achieved and special difficulties encountered. The working party defined what was meant by the types of operation included under afforestation, forest improvement, and reforestation. Governments anticipating a shortage or surplus of seeds or plants were again urged to inform FAO accordingly. They were also asked to send in particulars of types of tractors and other equipment that had actually proved successful in afforestation and reforestation work. It was agreed that the secretariat should collect and circulate information on methods employed for the protection of seed and plants against browsing animals and rodents, particularly rabbits. In establishing their planting programs, governments should provide for appropriate preventive measures against fire. The need was stressed for considering the latest findings in ecology and genetics,

while the attention of the International Union of Forest Research Organizations was drawn to the potential problems raised by the large-scale introduction by member countries of species from North America.

The working party considered that the particular difficulties which member countries had detailed in their reports were not in fact the basic factors affecting the development of afforestation and reforestation programs. The success of programs depended on educating the public to the importance of forests and on acquiring the necessary land and funds. Governments were asked to accord high priority to programs, giving priority, where conditions were suitable, to quick-growing species for the production of pitprops and pulpwood.

In view of the special importance attached to this subject, the Commision recommended that a similar working group should also meet before the next session to examine the further information submitted by member governments during 1952.

Logging Techniques and Training of Forest Workers

This item on the Agenda was referred to an ad hoc working group. As the result of the findings of this group, the Commission agreed to the setting up of a Sub-Commission as proposed by the third session of the Commission. As a first step towards the formation of the Sub-Commission, a Pilot Committee of some 8 10 members would be formed, comprising specialists from the following countries: Austria, Finland, France, Germany, Italy, Sweden, Switzerland and United Kingdom, and including, if necessary, representatives of other international organizations working in this field.

The terms of reference of the Committee would be to foster international collaboration in the field of felling, logging and timber transport, in order to support national efforts aimed at increasing productivity, including output of labor, reduction of waste, prevention of accidents, and the improvement in the standard of living of forest workers. The Committee would be authorized to appoint working parties should this prove desirable. The Commission considered that a meeting of the Committee should be held as soon as practicable. It also noted with satisfaction the newly established collaboration in this field with other international organizations.

Insect Pests and Diseases

This topic was also referred to an ad hoc working group and apart from certain amendments, the Commission concurred with the report of this group. The Commission agreed on the necessity for international collaboration on plant protection, and thanked the Secretariat for the work already carried out. It took note of the European convention signed by 15 governments, 18 April 1951, and also noted that the revised version of an international convention prepared in September 1951 would be submitted to the FAO Conference in November. The means whereby these conventions might be applied to forest trees should form the subject of further study.

The Commission asked the Secretariat to request governments to complete the list of experts working in this field and approved in principle the questionnaire prepared by the Secretariat, but suggested certain additional information and modifications of detail.

Statistics

A special working group on Statistics assembled prior to the fourth session to examine certain matters referred to it by the third session. The report of this working group, as amended and formally adopted by the Commission, contains a large number of recommendations addressed to FAO and to member governments with regard to statistical programs and procedures. It will be referred to the other regional Forestry Commissions and governments for consideration.

Excursion

The Commission was invited by the Director-General of Forests, Italy, to visit the afforestation work carried out at Monte Subasio. The techniques employed in afforestation and also in soil restoration proved of great interest to delegates; of special interest were the methods for establishing "gradoni" and for improving grazing. The work well illustrated an effective blending of forestry and agriculture, with due regard to the prevention of erosion, while successfully preserving the historic and aesthetic interests of the neighborhood of Assisi.

The Commission expressed its gratitude to the Director-General of Forests, Italy, for the opportunity to view this work, and to his staff who organized the visit.

Election of Officers

After a unanimous expression of confidence by the delegates, the Commission elected O.J. Sangar (United Kingdom) and E. Saari (Finland) as Chairman and Vice-Chairman for a further term of office of two years, Mr. Sangar's acceptance of the office being subject to the formal concurrence of his government.

Date and place of Fifth Session

It was decided that the Chairman, in consultation with the FAO Secretariat, should determine the date and place for the next session.

International Chestnut Commission

Various species of *Castanea* are of considerable economic importance to many countries of the world for their timber and fruit and as a source of tanning extracts. They are especially important to small landholders, farmers and rural communities as a means of livelihood.

But chestnut trees are threatened by a number of diseases, and in the United States of America *C. dentata* has been completely wiped out. In 1947 the French authorities became so alarmed lest the same situation occur in Europe that they called upon FAO for international action to combat disease, to find resistant species, varieties or types to replace affected trees, and generally to improve growing and utilization methods.

The Fourth Session of the FAO Conference at Washington, November 1948, when the matter was considered, believed that an inter-governmental Chestnut Commission should be created within the framework of the Organization, and urged all interested countries to become members.

To this end, the French Government subsequently invited the countries concerned, as well as several independent specialists, to participate in an International Chestnut Congress which was held in France from 5-16 September 1950.

Delegations were sent by France, Germany, Italy, Spain, Switzerland, and the U.S.A. Bulgaria sent an observer and FAO itself was represented. Other countries, including Belgium, Greece, the Netherlands, Portugal, Syria, United Kingdom and Yugoslavia asked to be kept informed of the work of the Congress.

The participants were clearly in favor of the proposal of the French Minister of Agriculture to establish an International Chestnut Commission; however, since some of the delegates had received no definite

instructions on this point, and because not all countries interested in chestnut problems were represented, it was thought advisable to leave the matter temporarily in abeyance. It was decided, instead, to establish a panel of experts under the chairmanship of A. Oudin, Director of the École National des Eaux et Forêts, Nancy, and with A. Biraghi, Director of the Institute of Forest Pathology of Florence University, as vice-chairman. This panel would continue, in close collaboration with FAO, the work already initiated during the International Chestnut Congress and organize further study tours in the future.

The following program of work was drawn up for the panel :

1. Preparation of a map showing the distribution of *Castanea* spp. and indicating the particular areas where disease is spreading.
2. Study of the ecology of *Castanea* and determination of the areas where economic and social conditions demanded that chestnut should be maintained, and of areas where, on the contrary, it should be replaced by other species.
3. Control measures for chestnut blight (*Endothia parasitica*) and the ink disease (*Phytophtora cambivora*).
4. Study of genetics in relation to disease control and problems of rehabilitation of chestnut plantations (resistant types, tannin-rich varieties).
5. Utilization of products ; collection and preservation of the nuts.

Interested countries were later invited to nominate national representatives to the panel, the Director-General of FAO having agreed that the Organization should provide secretarial services. The following nominations were received :

Austria : W. Wettstein, Director, Division of Plant Breeding, Federal Forest Experiment Station, Mariabrunn, Vienna.

France : H. Millischer, Forest engineer, National School of Waters and Forests, Nancy.

Greece : G. Kossenakis, Director, II Forestry Division, Ministry of Agriculture and Forestry, Athens.

Italy : A. Pavari, Director, Forest Experiment Station, Florence.

Japan : Kazuo Ito, Head, Forest Pathology Research Section, Meguro Forest Experiment Station, Ministry of Agriculture and Forestry, Tokyo.

Portugal : C. T. Fernandez, Forest engineer, Forest Research Station, Alcobaca.

Spain : P. Urquijo, Director, Plant Pathology Station, La Coruna.

Switzerland : F. Fisher, Forest engineer, Federal Institute of Forest Research, Zurich.

Turkey : Refik Erdem, Assistant Professor, College of Forestry, University of Istanbul.

U.S.A. : George F. Gravatt, Senior Pathologist, Division of Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville (Maryland).

Yugoslavia : Foreign Liaison, Division of the Council for Agriculture and Forestry, Belgrade.

Lebanon and the United Kingdom asked to be kept in touch with developments.

The first meeting of this Chestnut Working Party took place at Rome on 8 October 1951 and was followed by a study tour, lasting until 19 October, organized jointly by the Italian and Swiss authorities. In the course of this tour the following proposals and decisions were made :

(*a*) MM. A. de Philippis (Italy), H. Millischer (France) and J. Elorietta (Spain) were entrusted with drawing up a distribution map of the *Castanea* genus showing the incidence of diseases ;

(*b*) each country would submit a description of the various sites on which chestnut was growing together with the average dates of flushing, flowering and fruiting ;

(*c*) information on the best methods in use in different countries for the preservation of nuts would be submitted to the Secretariat and subsequently circulated to all countries ;

(*d*) information would be exchanged between the different countries on the means used to control the "Ink" and "Blight" diseases ;

(*e*) plants or other material resistant to these diseases would be exchanged to be grown in different areas. A standard form to accompany all the material was adopted ;

(*f*) data on the testing of chestnut timber would be supplied to interested countries. Increased utilization of chestnut wood for tannin extracts was recommended ;

(*g*) all member countries were invited to study the economic and social factors affecting chestnut cultivation and report the results at the next meeting ;

(*h*) an invitation by the representatives of Spain and Portugal to hold the next meeting in those countries in June 1953 was accepted.

The results of this meeting were later brought to the attention of the Sixth Session of the FAO Conference at Rome in November 1951. The Conference was somewhat reluctant to enhance the status of the Working Party to the extent of establishing a formal intergovernmental body concerned solely with the chestnut genus, but after strong representations from the delegates of interested countries, the Director-General was finally authorized to take steps to constitute an International Chestnut Commission, with statutes on the lines of those for the International Poplar Commission. The Conference proposed that the Commission should dissolve itself as soon as the difficulties now confronting the cultivation of chestnut were no longer of world-wide concern.

Corrigenda

Vol. V. No. 2 : page 55, para. 4, line 3 - for "grafting" read "cuttings".
page 84-85. The illustrations appearing with text "New Tilting Arbor Saw Table" and "Belsaw Circular Saw Shop", should be transposed.
Vol. V. No. 3 : "Loblolly Pine" article. Some of the acre/hectare conversions are inaccurate : the correct conversion factor is : 1 hectare = 2.471.

Equipment News

The continual development of forest utilization and woodworking industries is reflected in the increasing demand for information on new equipment. FAO's Forestry Division, on the recommendation of the FAO Conference, collects such information and sends it on request to member governments. The Forestry Division would appreciate receiving data from manufacturers all over the world ; specifications should be accompained by clear, sharp photographs (glossy prints). FAO, however, can accept no obligation to publish all such information received.

PRECISION DENDROMETER. — An instrument for measuring tree growth. It consists of a Starrett No. 655-FL inch dial gauge micrometer bolted across the top of a small T- shaped hardwood platform, so that the face of the platform can be held against the screw heads in making measurements. The two pieces of the platform must be securely bolted together to prevent warping. Three brass furniture corners, arranged in a triangle on the face of the platform, enable the operator to return the instrument to exactly the same position on the screw heads at each re-measurement. The micrometer reads accurately to 0.001 in. and it is possible to interpolate between the graduations. Each revolution of the large hand measures 0.1 in. The spindle has a 3 ft.

range of movement which is recorded by the 0.1 in. graduations on the small counter on the dial.

A template (1.5 x 8.5 in.) is used for a uniform spacing of the 3 round-headed brass screws on the trunk of the tree so that they are aligned with the brass corners on the platform. The screws penetrate the trunk to a depth of approximately 0.5 in. The screws can be reset if necessary to compensate for the radial growth of the trunk. The dendrometer measures the distance between the plane formed by the permanent screw heads and the surface of the bark. This distance decreases with growth.

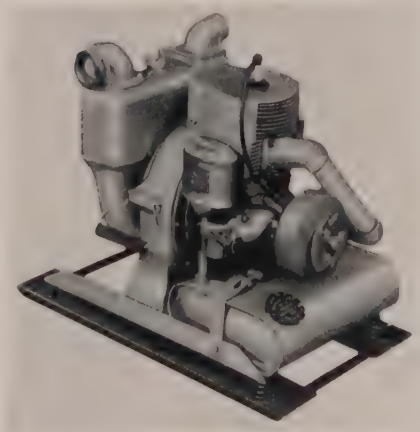
Error resulting from wear caused by the spindle repeatedly striking the bark surface is prevented by attaching a small metal or plastic square or disc on the dead bark at each contact point; a plastic wood disc is shown here. For checking instrumental error at each remeasurement, the investigator should place a set of 3 screws on another tree and then sink a fourth screw to a depth of 0.5 in. into the wood at the spindle contact point. Readings on the check tree will give the correction for instrumental errors. The dead bark should be reduced to about 3/16 in. thick before the screws are installed.

The dendrometer provides the forester with an accurate and rapid means of measuring the seasonal trend of changes in radial growth up to 0.001 in. resulting from the impact of treatments such as thinning, fire, pruning, fertilization and irrigation. The annual increase in radial growth resulting from these treatments cannot be measured accurately by the use of conventional methods. Only the instrument is needed for the readings but a set of screws must be permanently fixed in each tree used in research. Readings can be made on at least 200 trees in a single day.

L. S. Starrett Co., Athol, Mass., U.S.A.

AUTOMATIC TREE SEED PLANTER. — Weighs 5 lb. loaded and consists of a light shaft about the length of a walking stick, with a small seed hopper at the top and a cylindrical planting head at the bottom. The planting head is placed in direct contact with the soil and the seed pushed into the ground by means of plunger. Up to 7 acres a day can be seeded with this planter.

Perpetual Forests Inc., Dexter Horton Building, Seattle, Washington U.S.A.



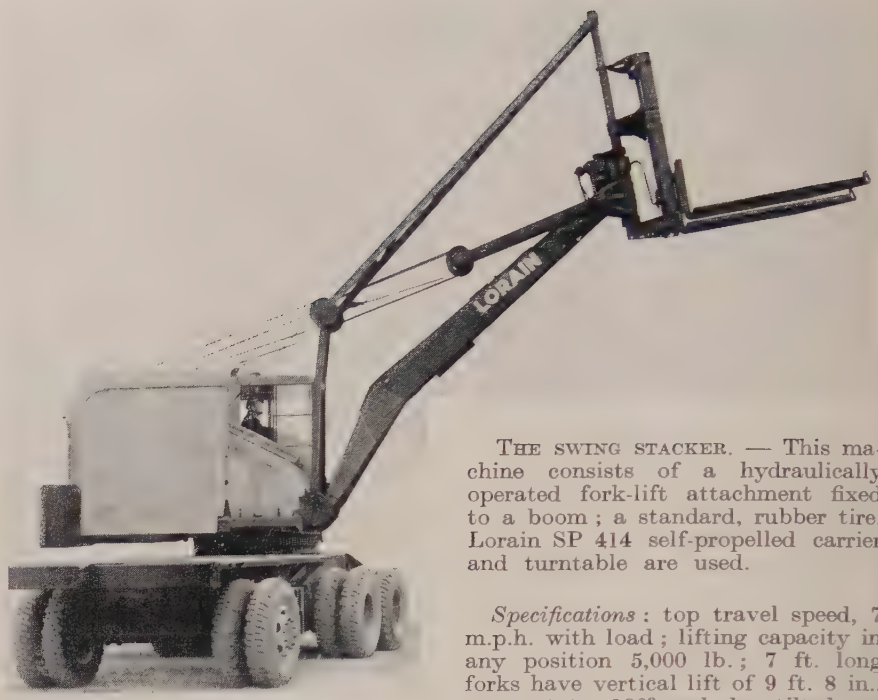
TERRY HIGH PRESSURE FOREST FIRE FIGHTING PUMP. — Turbine type pump with characteristics of both centrifugal and positive displacement unit ; of very light weight construction and can be fitted with a frame suitable for back packing for use in bush country. Pressure and volume can be varied to suit requirements by changing the impellers. At present these units can be obtained with capacities up to 50 and 60 gallons per minute, and pressures up to 225 lb.

Specifications: height 18.5 in., length 26 in., width 18.5 in., total weight, approx. 85 lb.

Terry Machinery Co. Ltd., Pumps-Generators, 10030 Montée, St. Laurent, Saint Laurent, Quebec, Canada.

FORK LIFT TRUCK. — *Specifications* : Capacity 15,000/18,000 lb. *Petrol engine* : SD four cylinder 70 BHP at 2,800 r.p.m., 50 BHP at 2,100 r.p.m.; *diesel engine*: Perkins P. 6 six cylinder BHP 55 at 2,000 r.p.m. 4 speeds, 1 reverse. Road speeds, 1st 22 mph ; 2nd 12.3 mph. ; 3rd 6.5 mph ; 4th 3.45 mph. Hydraulic hoist and controls. Overall width 7 ft. 1½ in ; wheelbase 6 ft. 10 in. ; overall length 13 ft. 6 in. ; outside turning radius 14 ft. 3 in.

Shelvoke and Drewry Ltd. Engineers, Letchworth, Herts, England.



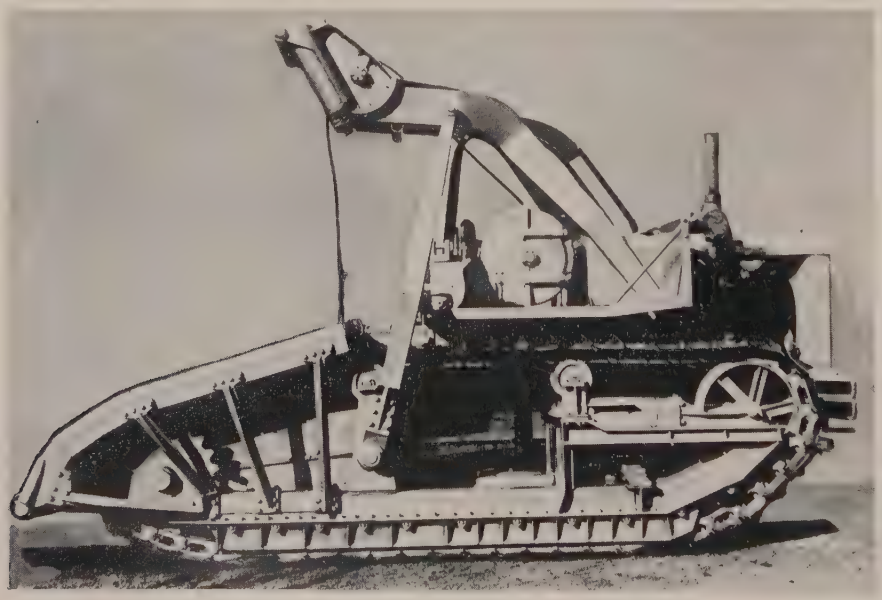
THE SWING STACKER. — This machine consists of a hydraulically operated fork-lift attachment fixed to a boom ; a standard, rubber tire, Lorain SP 414 self-propelled carrier and turntable are used.

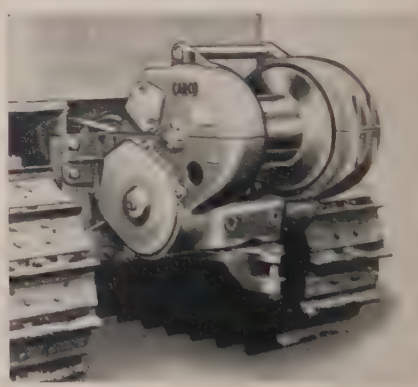
Specifications : top travel speed, 7 m.p.h. with load ; lifting capacity in any position 5,000 lb. ; 7 ft. long forks have vertical lift of 9 ft. 8 in., can rotate 180° and be tilted up and down approximately 10° ; turntable and fork lift front end can revolve through 360° ; with boom and fork lift completely raised, a height of 27 ft. can be reached.

The Thew Shovel Co., Lorain, Ohio, U.S.A.

U.S.F.S. TOMCAT LOG TRACTOR. — Arch tractor for skidding logs designed and built by the U.S. Forest Service. One of its principal objects is to provide ample track area for operation on wet muddy ground. On field tests over difficult and very muddy ground it has already proved to have the following advantages over conventional crawler tractors : 1) can haul log loads up to 50 per cent larger ; 2) by carrying its arch it requires less power output than by trailing it ; it can also be backed into difficult places and lined up for yarding out quicker than a trailer arch and reduces damage to young trees ; 3) it has the weight and stability to yard out a larger object ; 4) with proper power and gear combination and because of elimination of the trailer arch, it can return empty upgrade in at least one gear higher than conventional rigs ; 5) because of its wide tracks and well-proportioned track length span, it stays on top of muddy ground and continues operation when other types would bog down ; it also improves the roadway for other tractors. *Specifications* : overall length 18 ft. ; overall width 10 ft. 4 in. ; height ground to top of arch 12 ft. Comparison : *F. S. Tractor*: weight no pay load 46,400 lb. : track area on ground 9,360 sq. in. ; track pressure no log load 4.9 p.s.i. ; track pressure with max. load of 1/2 of 55,000 lb. on tractor 8.0 p.s.i. ; track plates 36 in. wide ; drawbar pull in low 32,000 lb. ; drawbar H. P. 120. *D-8 Cat.*: weight no pay load 39,000 lb. ; track area on ground 5,000 sq. in. ; track pressure no log load, 8.0 p.s.i. ; track pressure with max. load of 1/2 of 55,000 lb. on tractor - 8.0 p.s.i.; track plates 22 or 24 in. wide; drawbar pull in low 26,208 lb.; drawbar H.P. 113.

U.S. Department of Agriculture, Forest Service, Washington D.C., U.S.A.





THE CARCO "G" WINCH. — This winch designed for logging and general constructions fits tractors in the 80 to 120 belt-HP range. New features include concealed cable controls, smooth braking action, and choice of gears for high or low range of line speeds. Exterior nuts and belts are recessed, drum flanges are shrouded to minimize cable damage. An automatic brake is available with the Carco "G" winch as extra equipment. This brake allows the operator to set his brake before pulling in the load. The brake takes effect as the tractor clutch is disengaged, preventing the load from slipping back. It is said to be especially useful in arch logging.

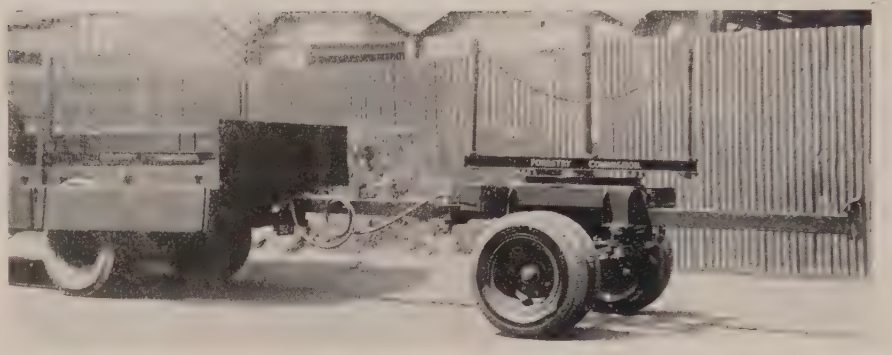
Pacific Car and Foundry Co. (Carco), Renton, Washington, U.S.A.

Mechanical elevator truck with salev fork lifts. — *Model* 33 *PD* : lifting capacity 3 tons ; *Model* 502 *PE* : lifting capacity 1,103 lb. Power wheels in front, guide wheels behind ; telescopic tilting shaft ; speed of lift, 39 f.p.m.

Specifications : *Model* 33 *PD* ; 2 cyl. petrol motor, gasoil unit type Z 2V ; 2 cyl. Renault Type 603 V ; length of standard fork 3 ft. 11 in., width 6 in. ; standard height of elevation 3 ft. 10 in. (on demand elevation can be increased to 14 ft. 8 in). ; weight 9,923 lb. *Model* 502 *PE* : 4 cyl. petrol motor, Renault Type 662 4 h. p. ; length of standard fork 2 ft. 4 in ; width 4 in.; height of elevation 8 ft. 2 in. ; weight 2095 lb.

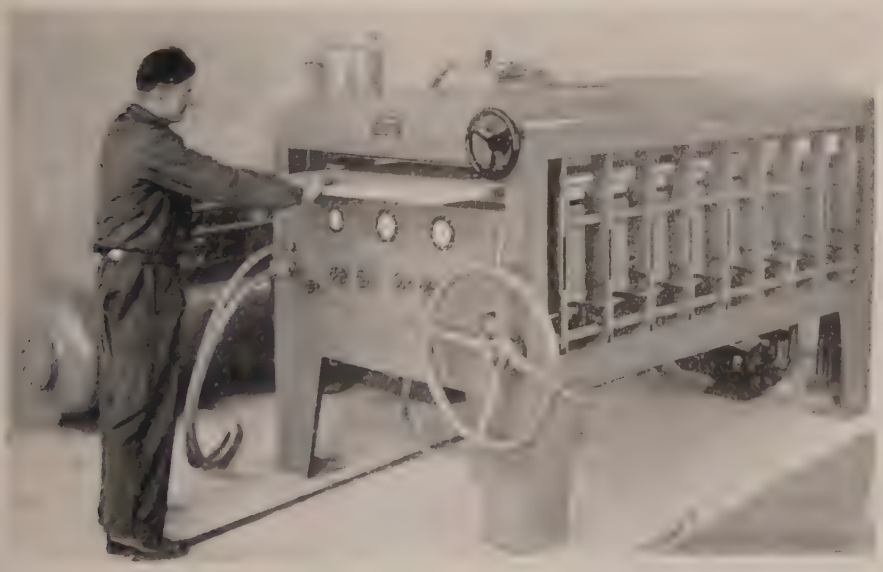
Special fixtures : hoist, rammer, bucket, hydraulic grab, automatic clamp, exhaust tank for inflammable material.

France Entreprise Nouvelle, 9-15 rue Paul Bert, Boulogne s/Seine, France.



Tasker trailer for haulage of light poles or timber. — Trailer designed to avoid dangerous overhang of long poles and small timber when hauled on standard 5-ton lorries ; has a load capacity of 4 tons, enabling a total load of 6 tons to be carried safely by lorry and trailer combined. It runs on 2 twin wheels with 34 x 7 tyres. "Girling" vacuum-operated brakes are fitted and controlled from the towing vehicle. The connecting pole is square and adjustable to give bolster centers of 13.5 ft., 15.5 ft., 17.5 ft., and 19.5 ft., and is attached to the rear carriage by removable pins. The bolster on the rear carriage is allowed to swivel 45° on each side of the normal and is fitted with two drop-in stanchions and chains. Trailer consists of a square frame surmounted by a turnable ring with main pin bearings ; under side of the frame carries the mountings for the road springs.

Taskers Ltd., Waterloo Iron Works, Andover, Hants., England.



Press combine Universal-20. A compressed air press for wood with flat or curved surface. Pressure can be applied from 4 - 6 lb. per sq. in. and average temperature is from 176.7 - 285° F. The fixed table is fitted with plates which can be heated (as can the pressure chamber) by electricity, steam or hot water as required. Coils have to be fitted for electric heating.

Specifications : *Press for flat surfaces* - no limit to length of wood which can be worked ; max. width 3 ft. 11 in. ; space between sheets 3.9 in. ; sheet dimensions 7 ft. 3 in. x 3 ft. 11 in. ; normal specific pressure 7 — 9 lb. ; normal total pressure 220,500 lb. ; normal temperature of sheets 176.7° - 285° F.

Press for curved surfaces — max. dimensions of wood 6 ft. 7 in x 3 ft. 3 in. ; max. depth of wood 8 in. ; dimensions of pressure chamber 7 ft. x 3 ft. 8 in. x 11 in. ; normal pressure up to 6 lb. per sq. in.

Power consumption ; heating entirely by electricity, 12 kw. ; motor for hot water pump, 0.75 h.p. ; compressor unit, 3 h.p. ; caloric units required for heating water, 18,000 ; approx. net weight, 7,718 lb. ; approx. net weight of compressor unit, 882 lb.

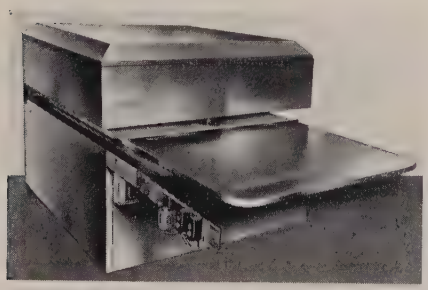
Ulrich Steinemann S.A., St. Gall, Winkeln, Switzerland

BARKER AIR CHUCK. — This scraper automatically adjusts itself to follow contour of the log ; only the bark is removed ; scraper does not cut into the sapwood. Instantaneous action of the air cylinder eliminates log slabbing, when logs are released. Scraper unit and air chuck can be adapted to any standard barker, or a complete unit can be made to meet requirements. 100 lb. air pressure is required for most efficient operation.

Ederer Engineering Company, 2931 First Avenue, South Seattle 4, Washington U.S.A.

PLYCOR ONE-MAN ELECTROGLUER. — Designed for fast, efficient high-frequency gluing of lumber cores, and requires only one operator who handles the glue spreading, lays up the stock and removes the finished cores. This equipment is capable of producing from 3,000 to 6,000 sq. ft. of core stock per day.

The One-Man Electrogluer is equipped with both top and side pressure cylinders and a Westinghouse 5 kw RF generator. Both machines are fully shielded. The 2-station lay-up table is pivoted in the center so that one half is in curing position inside the press while the other half extends in front forming the lay-up table, which is motor-driven. When the top cylinders move upwards they lift the top electrodes, the side pressure cylinders, and the back stop, thereby leaving the pivoting table free and unencumbered so that the operator can revolve it. This brings the freshly laid-up material into curing position and delivers the glued-up core to him. A glue spreader on a conveyor equipped with gravity roll infeed and conveyor chain outfeed is also included.



Plycor Company, Division Earl Hart Woodworking Machine Co., 565 West Washington St., Chicago 6, Ill. U.S.A.

NEW HOMELITE CHAIN SAW. — This new gasoline chain saw, model 2¢ LCS, 4 h.p. weight 27 lb. has one simple control — a throttle button on the handle. Automatic centrifugal clutch stops chain when engine idles and prevents overload when chain binds in cut. Concentric bowl carburetor permits operation at extreme angles.

A wide range of blade sizes is available. One-man straight blades are available in 18, 23 and 28 in. sizes ; two-man straight blades are available in 23, 28, 34 and 42 in. sizes. Bow saws for one or two-man operation are available in 18 and 22 in. sizes.

Homelite Corporation, Port Chester, New York.

ONE-MAN CHAIN-CUT SAW, ELECTRO TYPE, PPK 40. — Saw is fitted with a special chain feed with Y-connection at end of blade preventing overheating, and counteracting the effort required by the motor resulting from the friction of the chain. Patent chain knife with device for regulating and greasing by gravity, designed for cutting all kinds of wood.

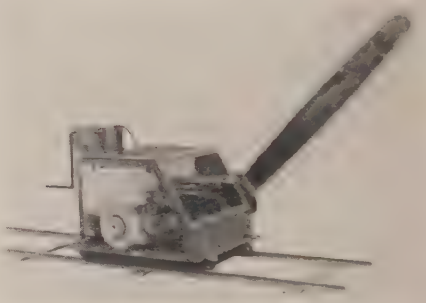
Specifications : Saw controlled by generating sector or plant with 2-3 h. p. motor of 2-phase or 3-phase current, 220/380 volt, 50 cycle ; fitted with high-resistance steel blade of 16, 20 or 24 in. length ; speed of cut approx. 4.7 sq. in. per second with power consumption of 1 K.W.H. 48 to 2 K.W.H. 22 according to kind of wood ; weight, approx. 40 lb.

Etablissements PPK, 45-47 Boulevard Saint-Denis, Courbevoie (Seine), France

GASOLINE DRIVEN CHAIN SAWS, REED-PRENTICE MODEL 50. — 5 h.p. gasoline-driven portable chain saw for both one and two-man operation. One-man R. P. models range in cutting capacity from 20 to 36 in. while two-man models equipped with an idler type tailstock are available in 24 in., 30 in., 36 in., 48 in. and 60 in. capacities. The one-man unit equipped with a 20 in. open end bar and chain weighs 45 lb ; the two-man saw complete with 30 in. guide bar weighs approximately 55 lb.

Handlebars and float-type carburetor remain upright for all operations, as the engine and cutting attachment swivel a full 360° and lock at any angle for notching, felling and underbucking cuts. Automatic clutch stops chain when engine is idling and provides overload protection. Pressure-fed oiling system lubricates chain in all cutting positions.

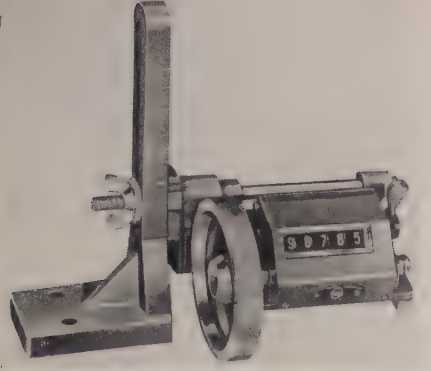
Reed-Prentice Corporation, Worcester 4. Mass. U.S.A.



PPK DECK SAW FOR CUTTING IN WATER. — Saw consists of cutting unit 4 ft. 9 in. long composed of a blade with Y-connection and chain for use on soft or hard wood. A Brampton Duplex chain with chain shield links the motor with the cutting arm.

Motor : PPK petrol engine with 2 vertical cylinders of 30 cu. in., 15-18 h.p. at 4,000 r.p.m., automatic clutch. Grease-box with pump and tubing. The machine is fixed to a carriage which runs on a 20 in. gauge rail (weight of rail : 1.25 lb. per sq. ft.) with four leverage rings for the maintenance of the equipment. A shield protects the equipment from damage. A winch is fixed to the front of the frame from which the end of the cable can be attached either to the cross-bars or to a peg sunk in the ground. Chain greasing by gravity and by hand pump.

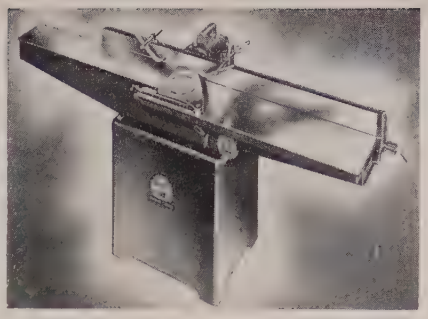
Etablissements P.P.K., 45-47 Boulevard Saint-Denis, Courbevoie, (Seine), France.



ACCURATE TIMBER MEASURING UNIT. — This instrument records accurately lengths of timber in measurements of yards, feet and inches or meters and decimeters, as required. In operation the recording unit can be raised or lowered by simple wing-nut adjustment to suit the thickness of timber to be measured ; a graduated scale marked on the pillar bracket determines the necessary setting position. In recording, the timber contacts a frictional wheel, having a knurled periphery which ensures accuracy and negligible wear.

Other special features of the unit are : automatic brake which stops the frictional wheel immediately. Instantaneous reset by lever or detachable key as desired. Measurements are indicated bybold white figures 9/32 in. high on black background ; five figure recording capacity : mounting to the machine is effected by two screw holes in the base.

English Numbering Machines Ltd., c/o John Mitchell & Partners Ltd., 9 Bennet Street, St. James's, London S.W.1.



BOICE CRANE 6 INCH AND 8 INCH JOINTERS. *Specifications*: 6 in. model: overall length 60 in. ; width front table 9 in. ; width rear table 8 in. ; height of fence 4 in. ; length of fence 48 in. ; height floor to table 36 in. ; depth of cut max. $^5/_8$ in. ; cutterhead diameter $3\ ^1/_4$ in. ; cutting circle diameter $3\ ^3/_8$ in. ; 3 knives in cutterhead ; cutterhead speed rotor on cutterhead (direct) drive, 3,300 r.p.m. ; cutterhead speed V belt drive, 4,500 r.p.m. ; power rotor on cutterhead drive .75 h.p. ; power V belt drive, 1 or $^3/_4$ h.p. ; weights jointer with motor and floor stand 460 lb.

8 in. model : overall length 84 in. ; width front table 11 in. ; width rear table 8 in. ; height of fence 4 in. ; length of fence 66 in. ; height floor to table 36 in. ; depth of cut max. $^5/_8$ in. ; cutterhead diameter $3\ ^1/_4$ in. ; cutting circle diameter $3\ ^3/_8$ in. ; number of knives in cutterhead 3 ; cutterhead speed rotor on cutterhead (direct) drive 3,500 r.p.m. ; cutterhead speed V belt drive, 4,500 r.p.m. ; power rotor on cutterhead drive 1.5 h.p. ; power V belt drive 1 or 1.5 h.p. ; weight, jointer with motor and floor stand 650 lb.

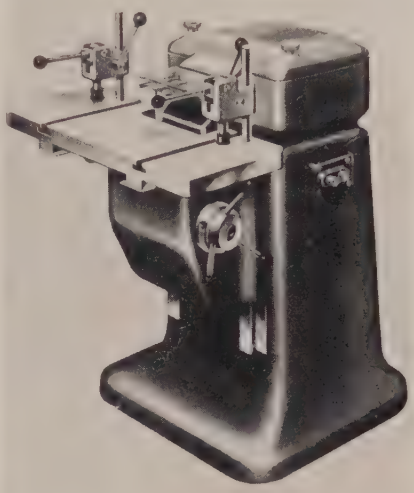
Oren O. Gallup Inc., Two Lafayette Street, New York 7, N.Y. U.S.A.

ALTERNAX MORTISER. — On this machine, reciprocating side chisels, and a face cutter with self-clearing action, operate horizontally.The wood is secured to a movable table by quick action clamps and is fed to the cutters acting at 2,800 strokes per min. by means of a hand lever until the adjustable depth stop is encountered.

Specifications : mortise length, $1\ ^3/_{32}$ - $2\ ^1/_2$ in. ; thickness, $^5/_{64}$ - $1\ ^3/_{16}$ in. ; depth $4\ ^1/_3$ in. ; table length $27\ ^1/_2$ in. ; width $11\ ^3/_4$ in. ; rise and fall 6 in. ; motor, 1 h.p. 2,800 r.p.m.

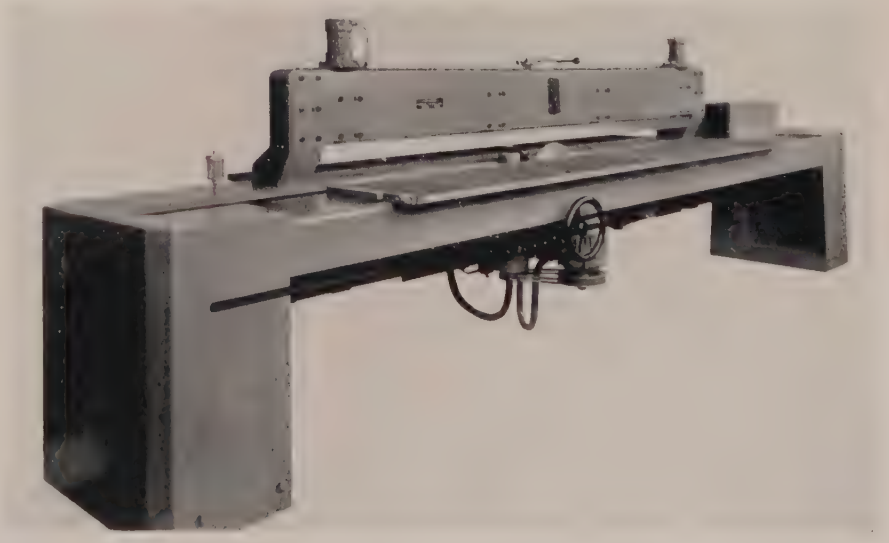
Apart from normal mortise joints, many other types are possible with the same tools — joggled tenons, simple or multiple slit and tongue joints, straight tails, dovetails, slots, etc..

The Kingsland Engineering Co. Ltd., 25-37 Hackney Road, London, England.



AUTOMATIC VENEER JOINTER. Substructure of machine in box form is designed to hold its shape and to ensure stability. Tool-bearing carriage moves on a specially covered slide bar with automatic lubrication. This carriage supports the circular saws, the cutter heads and their motors. Mechanical pressure is applied by means of a crank ; when the pawl is opened the pressure bar is released instantaneously and automatically.

Specifications : max. wood-working length 27 yds. ; max. height of pressed veneers 1.2 in., min. height 0.08 in. ; diameter of blade of circular saw 1 ft. 2 in. ; speed of blade 3,500 r.p.m. ; cutter head with three 2.6 in. knives ; speed of cutter head 5,850 r.p.m. ; motor for circular saw, 3 h.p. at 2,800 r.p.m. ; motor for cutter head, 2 h.p. at 2,800 r.p.m., and feed motor, 1 h.p. at 1,400 r.p.m. ; weight of machine 3,682 lb.



Ulrich Steinemann S.A., St. Gall, Winkeln, Switzerland

News of the World

The items appearing here are condensed selections of news thought to be of interest to readers of UNASYLVA. *They are grouped alphabetically by countries under headings currently used by the Forestry Division for reference purposes. The Editor will be glad to receive direct from readers authenticated items of interest and of news value for this part of the review.*

General

CANADA

• In the hope that they will inspire public interest, the Pulp & Paper Magazine of Canada has published reproductions of a group of forest landscapes by six eminent Canadian artists. The original canvases are the property of the pulp and paper industry of Canada which, through its Association, commissioned the artists to depict, each in his own terms, the chief tree species at present employed in the manufacture of pulp and paper. The paintings will be used in many ways. The original canvases will tour Canada and be displayed in art galleries from coast to coast. Black and white reproductions will be used in advertising. As these paintings and their reproductions appear throughout the and, they will serve not only as a permanent reminder of the economic significance of the forests, but also as a reminder to Canadians of their forest responsibilities. For Canadians are often unmindful of the fact that they own nine-tenths of the woodlands, and that the forests and the forest industries account for almost a third of the primary production of this country. On this primary production is based the vast edifice of all Canadian trade and commerce. Thus, directly and indirectly, the forests generate at least a quarter of the income of all Canadians, and of total forest wealth, pulp and paper accounts for one half.

The paintings, too, will be used to emphasize the fact that the pulp and paper industry, recognizing its responsibilities, has adopted and publicly declared a forest policy of perpetual yield ; and that by improved management, better utilization, research, and by many other means, substantial progress has already been made towards the implementation of this policy.

CYPRUS

• In the course of the past twenty-five years considerable progress has been made in forestry in Cyprus. Among the specific results achieved are the widespread elimination of goat grazing in the forests ; the construction of a fine road and telephone network ; an extensive program of afforestation ; the establishment of an annual Arbor Day ; a spectacular reduction in forest fires ; the setting up of a Middle East Forestry School ; the conversion to oil from wood burning ; and the removal of squalid, poverty-stricken villages. These results have been accomplished through slow, persistent and sympathetic work with the villagers themselves and with the active support of the Government.

One little-known aspect of forestry in Cyprus is that there is a large-scale demand for the seed of such species as Aleppo pine (*Pinus halepensis*), cypress, acacia and eucalyptus by neighboring countries, and that collection of seed on a large scale gives employment to scores of villagers. The collection, drying and storing methods have been worked out on a simple basis which is practicable for the village people. Jordan, Lebanon and Israel have all bought tree seed in quantities.

NEW ZEALAND

• The New Zealand Institute of Foresters, Inc., continues its active and varied program. The annual general meeting consists of one day devoted to Institute business and to presentation and discussion of technical papers, with usually one or two days spent in field trips to plantations and indigenous forests of particular interest. The 1951 meeting was held in June at the Château Tongariro.

There are four grades of members : honorary members ; members ; associate members ; and student members. The official publication is the New Zealand Journal of Forestry, which is published annually and is now in its sixth year.

The Institute participates in the work of the Nature Protection Council, a body recently set up to co-ordinate efforts toward reservation and protection of natural associations of plants and animals. It also took part in May 1951 in the Seventh New Zealand Science Congress, held at Christ church. A section of Forestry, Agriculture and Soil Science at the Congress dealt with marginal land, hydrology and land use, and other problems of land use with particular reference to soil, agricultural and forest problems of several of the major geographical and soil areas of the country.

A Terminology Committee has prepared the draft for a glossary of technical terms. The Institute has prepared data to support the case of foresters as a group for consideration in the general regrading of the Public Service to be undertaken soon.

SWITZERLAND

• Mr. A.-J. Schlatter, former federal inspector, has been appointed by the Swiss Federal Council to the post of Inspector General of Forests, Hunting and Fishing in succession to the late Mr. E. Hess. Mr. Schlatter, who entered the Government Service in 1930, had for thirteen years been Inspector of Forests for the second district (arrondissement) of the Canton of Vaud at Aigle (Ormonts).

UNITED STATES OF AMERICA

• The City of New York has one of the world's great surface water supply systems. It must produce an average of 800 million gallons (3,028 mill. liters) of fresh water a day and, during midsummer, consumption reaches 1,400 million (5,299 mill. liters). To meet the average daily consumption and at average yields, an area of 1,200 square miles (3,108 km²) of watershed is required. In fact, the present area of the city's supply is only 1,250 square miles (3,238 km²), and thus reservoiring is required to equalize supplies. On the city watersheds a wide range of watershed problems is found, since they are situated on both private and public land, on untouched public forest preserves and state parks and heavily exploited grasslands used for dairy farming. There is also a wide variety of topography and geology.

With present information, it is at least doubtful that complete closure of forest lands to utilization is efficient from the standpoint of obtaining maximum usable water yields. On the contrary, if forests were maintained to prescribed composition, basal area and age class and unnecessary vegetation removed, transpiration losses might be significantly reduced and water yields thereby increas-

ed to give a greater margin of yield over consumption than now exists.

The use of sloping land for pasture is as much as 44 percent of the total area in some drainage basins, and as much as 80 percent of the land shows moderate erosion; especially on steep and rocky areas, pasture yields are low and erosion severe. Thus one major watershed problem is to change the form of land use over substantial areas. It is particularly desirable to exclude cattle from steep lands with thin soil by fencing, so as to eliminate unproductive pastures and to substitute forest for grass cover. The lack which this presents is not insurmountable, and it would seem that selected areas should be placed under public ownership as a pre-requisite to planting of forests. In past decades a great deal of forest planting has been done successfully on the older of the two major watersheds, and beneficial results are evident.

Such a remedial program would necessarily include detailed land use surveys, and detailed field examinations of critical areas. Land use adjustments are needed on steep, unproductive and overtrampled pastures. Public acquisition for the purpose of streambank protection and channel control, protection of submarginal and unproductive lands, as well as of steep slopes and thin soils is also required. In many areas improvement in the harvesting of wood products from private land is also necessary. Better management of forest lands is needed through stand improvement to improve infiltration, to assist in the accumulation of snow and delay of snow melt, and through the reduction of transpiration by controlling the cover.

Forestry Education

United States of America

• In 1950, the forest schools of the U.S.A. conferred 2,321 bachelor's degrees, compared with 1,443 in 1949; 275 master's degrees, compared with 205; 29 doctor's degrees, compared with 12. All these figures represent new peaks for the schools. Of the bachelor's degrees, 2,039 were conferred by the 22 accredited schools, the remainder by the 12 non-accredited schools. Of the master's degrees, 268 were conferred by the accredited schools, as were all the doctor's degrees. Undergraduate enrollment has dropped from 7,469 in 1949 to 5,935, and the number of seniors from 2,501 to 1,730. On the other hand, the number of graduate students, working both for master's and doctor's degrees, has increased. The proportion of veterans among undergraduates has dropped from 75 percent in 1948 to 43 percent in 1950, whereas among graduate students, the proportion has changed only from 77 to 74 percent.

Union of Soviet Socialist Republics

• Armenia, one of the smaller Transcaucasian Republics of the Soviet Union, borders in the southwest and south on Turkey and Iran. From the standpoint of forestry, Armenia is of interest not because of the extent of its forests, which are small, but because of the important hydrological role which they play in its national economy. The country is poor in coal and oil, but rich in water power resources. One of the most important sources of hydro-electric energy is Lake Sevang, situated at an altitude of 1,916 meters (6,286 ft.) above sea level, and the river Zanga which flows from it, and along which a number of powerful electricity stations have been constructed. Armenia is also water conscous for another reason; from time immemorial its agriculture has depended on irrigation. Water conservation for electric power development and for irrigation purposes through forestry is therefore the most important task of the recently created Armenian Ministry of Forestry.

The forests of the Armenian Republic cover only 10 percent of its territory or about 330,000 hectares (815,430 acres); many regions, in fact, are entirely treeless. The absence of a protective forest cover and primitive land use in the past caused excessive erosion and the formation of gullies and torrents which assumed alarming proportions over large areas. To control the water regime and check erosion, the Ministry has instituted a comprehensive forest policy for existing forests, is undertaking engineering works to stabilize mountain slopes and carrying out extensive afforestation of treeless areas. The forests have been divided into two groups: one group, covering 91 percent of forest land, or about 300,000 hectares (741,300 acres) has been declared protection forests. Here no commercial cuttings are allowed, only removal of dead trees, thinnings and other cultural operations to improve the stand and increase its density. The protection forests are located chiefly in the northern part of the country, along shores of mountain streams, on steep slopes and divides. The other group — covering 9 percent or 30,000 hectares (74,130 acres) is open for exploitation in the form of gradual cuttings within the limits of the annual growth with obligatory renewal of the cut-over land. These commercial forests are located in the Alaverd and in the Noemberansk regions. The dominant species of the forests are hardwoods (oak, beech, ash, basswood, etc.) All forests are worked according to definite management plans to be revised at the end of each 10-year period.

In addition, the Ministry is engaged in a campaign of checking erosion by afforestation. The mountain slopes in the vicinity of the cities of Kirovakan, Dilijan and Kafan which in the past were burdened each year with erosion debris, have now been planted and erosion checked. During the last two years more than 5,000 hectares (13,355 acres) of eroded land have been afforested. Some 800 hectares (1,977 acres) of bare, stony and rocky mountain slopes on the northern and northeastern sides of the capital of Armenia, Erevan, are now covered with forest plantations. To protect agricultural crops from hot dry winds, in 1949 shelter-belts were planted over an area of 1,500 hectares (3,707 acres). Three forest nurseries covering 400 hectares (988 acres) are in the process of being established. A forest school with a 2-year course in the city of Kirovakan trains foresters of lower grades, and in 1950 some 50 students graduated from it.

Fundamental Science

United States of America

• An interesting combination of two recent scientific techniques has been made in studies of the bogs of the Quetico-Superior country in the Lake States area of the northern United States and southern Canada. The pre-historic course of development was studied by use of the pollin grain technique, which showed that the first invaders after glaciation were white spruce (*Picea glauca*), balsam fir (*Abies balsamea*) and some jack pine (*Pinus banksiana*). Then a major climatic change resulted in replacement of the spruce fir by a predominantly jack pine forest which persisted for a long time and then gradually merged into a forest of jack pine associated with red and white pines (*P. resinosa and Abies concolor*) and finally in an increase of spruce and fir again. Estimates of the time interval involved in any or all of these steps depend on the depth of bogs and estimates of the time interval per vertical foot, or on similar inexact estimates. However, the method of determining the loss of radio-activity in the carbon found in the bogs makes it possible to estimate the years which have elapsed since a particular bog sample was laid down, with a possible plus or minus error of 4 or 5 percent.

The bogs show that great fires have occurred and have left carbon deposits, and the radio-active carbon method indicates that the most severe fires were from 3,000 to 3,500 years ago. Formation of peat has apparently proceeded at the rate of about one foot (30 cm.) in 438 to 500 years. The combination of the two techniques seems to offer an opportunity for more accurate determination of the time intervals involved in the development of existing forests.

• In a study recently made in the northwestern United States, southwestern Canada and Alaska, the techniques of estimating dates of recent glacier advances and recessions have been improved through study of tree growth layers. It is possible to estimate the time since a glacier advanced beyond a given point, and the

approximate rates of recession, by studying cross sections of the trees injured or tilted by ice, since such glacial action changes the form of growth layers from concentric before tilting, to asymmetric after tilting. Similarly, the age of the oldest tree along the trimline — that is, the edge of the undestroyed forest — indicates the period of the occupancy of the land by glacier, and the age of young forest following recession indicates the date of recession.

The methods developed, expanding those previously used, will be valuable too, in studying glacial behavior in various parts of the world.

• Precise measurements of the radial width of annual growth rings of big trees and ponderosa pine, and the sequences of different width rings, have hitherto been made by Huntington and MacDougall and interpreted as indicators of rainfall characteristics of individual years and groups of years for periods before the establishment of standard rainfall records. Acceptance of this method depends on the valid correlation of tree growth and rainfall within the period of formal rainfall records. If the method is valid, the results of such studies may be of great value to scientists in indicating, for example, long-term changes in precipitation, the alternation of above and below normal precipitation, and the relation of such shifts to historical facts such as the migration of primitive peoples, expansion or contraction of forests, currents and severity of forest fires.

A study of selected dominant trees of several species growing in several locations in north central New Mexico has recently been reported, the data from the cores having been subjected to detailed statistical analysis. Rainfall records from stations relatively near the forest plots were used. Among the conclusions were : (1) correlation between rainfall from March to July and tree growth was high ; (2) trees respond very nearly 100 percent to fluctuations of rainfall on the immediate site ; (3) quality of correlation is little affected by the nature of the species ; (4) within the groups, disagreement correlation among individual trees emphasizes the extremely local effect of site factors, the divergence increases with the increase in distance, as measured in yards rather than miles. The highly localized microscopic site factors are extremely important in determining the behavior of individual trees ; (5) the higher the correlations among the trees, the higher their correlation with rainfall ; (6) trees from wetter sites showed the highest correlation and also the greatest increases in growth, whereas trees from drier sites were poor recorders of changes in rainfall characteristics. General conclusions are that variations in tree growth follow variations in March-July rainfall from year to year of the immediate site. Secondly, it is believed that changes of internal agreement among trees, changes of the average variation, and the average departure from the mean variation, can be used as a method to reveal changes in rainfall through years where the amount of rainfall and derived soil moisture approximate to those at the site of the primary forest stations used. It does not appear that this study validates on a wholesale and generalized basis the use of growth rings as a measure of precipitation.

Silviculture

Australia

• Small plantations of *Pinus radiata* were established on the predominantly sandy soils in the south-east of South Australia as early as the 1870's and sawmilling operations began in the early years of the twentieth century. Most of the forests which have been clear-cut were maintained in an unthinned condition for up to ages of from 20 to 40 years, and therefore provided information on yields of unthinned forests at various ages and on various site qualities. Although thinning had been done on some plantations, systematic records were not kept. Therefore, in 1935, the Woods and Forests Department established a series of sample plots on which it has maintained systematic measurements to study the problems of thinning. The view has been held that the prime purpose of public forestry is to produce maximum yields of all the kinds of usable material required by consumers, and thus the studies have not been concerned with the economic aspects of forestry.

While the soils may appear similar superficially, there is in fact an enormous range of yield, and a series of five site quality classes has been worked out. The enormous yields of such plantations are well-known, and even mediocre sites produce an average yield of nearly 8,000 cubic feet (227 m^3) in 30 years. Thinning studies are by no means complete and are weak in relation to the highest site qualities, but analysis has made it possible to establish guides applicable to this forest zone. The more important conclusions are :

1) *Initial spacing.* Taking into account both utilization of the soil and tree form, optimum spacing is 6 ft. (1.8 m.) for site quality I, 7 ft. (2.1 m.) for site qualities II and III, 7-8 ft. (2.1 - 2.4 m.) for site quality IV, and 8 ft. (2.4 m.) for site quality V.

2) *Effect of thinning on volume production.* For site qualities II, III and IV, a comparatively moderate thinning after 10 years to a density of from 350-400 trees per acre (860-990 per ha.) increases volume production over both the unthinned stand and one thinned to 300 trees (740 per ha.) This superiority is maintained till near or after 20 years, after which stocking of 300 is preferable.

3) *Danger from wind.* Development of windfirm stems is a major objective of thinning, and for this purpose the time for the first thinning is when the dominant height is around 60 to 65 ft. (18-20 m.) and not more than 70 ft. (21 m.). This corresponds to 10-11 years on site quality I, 11-12 years on site quality II, 13 years on site quality III, 14-15 years on site quality IV, and 16 years on site quality V. Adoption of this schedule is necessary to safeguard against windstorms.

4) *Intensity and frequency of thinning.* The recommended schedule is as follows :

Thinning density	350-400	275-325	200-250	150-200
	(..... Age in years .....)			
S. Q. I	10-11	14-15	19-20	24-25
II	12	17	22	27
III	13	19	25	31
IV	14-15	21-22	28-29	—
V	16-17	23-24	30-31	—

5) *Thinning yields and techniques.* The use of modern methods of extraction requires the clear felling of extraction rows at regular intervals to allow the entry of trucks, and this inflates the yields from the first thinning, which will run from 1,000 to 1,500 cubic feet or more per acre (70 m^3 - 105 m^3 per ha.). In addition, trees of undesirable form, and suppressed trees should be removed. In the second thinning, reserved trees capable of making the best growth should be not less than 40 percent of the total height in green crown, or 50 percent for production of large diameters.

Because of the very rapid growth and because material from trees of as low as 6 inches (15 cm.) diameter is saleable, economic opportunity does exist for widespread application of systematic, frequent and moderate thinning to these forests. In general, it is recognized by the Department that very short rotations are unlikely to build up or even maintain the soil, and the general opinion is to work toward longer rotations with selected crop trees rather than toward short rotations. Experiments to date show that the recommended spacing and thinning practices will increase the growth and yield over those of unthinned stands and, in addition, supply the market with usable material from the thinnings.

Canada

• As part of its woodlands research, the Pulp and Paper Research Institute of Canada has produced a study

on cutting methods in the pulpwood operations of eastern Canada. The study does not cover all conditions, but does deal with many of the different ecological environments where pulpwood operations are now in progress. Each of the many situations has its own combination of geographical conditions such as latitude, altitude and exposure; of climatic factors (temperature, precipitation and light); and of edaphic factors (soil requirements, soil temperature, soil moisture, soil reaction and organic layers). Each of these, in various situations, has a dominant effect on the type of cutting which will obtain the most successful regeneration and result in satisfactory utilization of the growing capacity.

The four basic cutting systems — clear-cutting, seed tree cutting, shelterwood cutting, and selection cutting — were studied, in each case as to effect on soil and regeneration, on age composition, and on advance growth, and the techniques of each are described. The economic considerations, both in the short run and in the long run, vary under each system, and an analysis is made of these factors. Cutting systems must be related to soil temperature and soil moisture conditions as they, in turn, effect establishment and growth of regeneration, and, in addition, must be related to the type of stand, whether even-aged or uneven-aged.

At present, the system most commonly used is clearcutting, largely because it is cheapest in harvesting virgin stands. It may not be the cheapest under a long-term plan of obtaining satisfactory regeneration.

The conditions under which each of the basic systems constitutes good forestry practice are: (1) Clear-cutting when satisfactory advance reproduction is present, when stands to be cut are overmature and are composed of intolerant species, and when raw humus is prevalent as in northern regions. (2) Shelterwood cutting when neither clear-cutting nor selection cutting will give best results and when previous stand treatment, mainly thinning, has been applied. (3) Seed-tree cutting when large areas are ready for a final cut but advance growth has not become established and, since seed trees must be wind firm, when the stand has had previous thinning. (4) Selection cutting when growth conditions are favorable, the stand is uneven-aged and is composed of tolerant species.

In general, forest management is best served by keeping stands as even-aged as possible, since then natural units are well-defined, better control can be exercised over forest operations, and estimates of growing stock increment and depletion are more readily obtainable.

Even though departure from clear-cutting tends to increase the cost of pulpwood, it is known that there are offsetting considerations, such as the fact that leaving small trees reduces the average cost per unit of volume. The system used will always have to balance silviculture and cost considerations, but in order to obtain suitable regeneration, which is now not universal, it will be necessary to accept some increases in cost. Even with the most intelligent application of cutting systems to the particular problem of individual sites, there will be failures of natural regeneration and some planting may become necessary, but the degree of success of natural regeneration should be substantially increased if the findings of this study are put into practice.

Egypt

• The practice of growing shade trees along main roads is being extended. Farmers are also growing timber trees for shade, as windbreaks, or for boundary demarcation. In the Sinai Peninsula, a belt of trees, five km. (3 miles) long and five meters (16 ft.) wide, is found to be essential to stop the movement of sand dunes which hinders the extension of cultivation in this region. Already 850,000 trees have been grown in this belt. Another belt in the western desert has been started, where 1,700,000 trees have been grown.

United States of America

• For 20 years the U.S. Forest Service has sown common mustard seed on burned mountain watersheds in Southern California, as the quickest method of restoring the protective cover. When sown promptly after fire, the seed germinates rapidly and the plants hold the soil until the slower growing native grasses and brush come back. Eventually the mustard disappears.

The first sowing was done by hand, but is slow and costly. Later, airplanes were used, thereby halving the cost, but resulting in poor distribution of seed over the rugged country, since not all areas could be covered. Recently, the helicopter has been used effectively. In one case, 1,045 acres (423 ha.) were covered within 8 1/2 flying hours. The cost was slightly in excess of that by airplane, but the seed distribution was uniform and as good as that obtained by hand. In another case 44,000 acres (17,807 ha.) in two areas were seeded by helicopter. It is evident that the use of this machine in such work will increase, since it is as cheap as any other method, is far safer to operate in rugged country than the airplane, and results in excellent distribution of the seed.

• It would be impossible to produce the many millions of trees in various nurseries throughout the United States if hand weeding had not been superseded by chemical weeding in many nurseries. Chemical weeding is now cheap, safe and effective, and provided proven techniques are utilized, it is in no way a questionable practice. However, although satisfactory techniques have been evolved for various places, there is still much to learn. Weeding has always largely contributed to nursery maintenance costs, and any country would be well advised to investigate thoroughly the possibilities of chemical weeding.

• In part of the high-site-quality pine and fir types in California, the sprouting habit of tan oak (*Lithocarpus densiflora*) and madrone (*Arbutus menziesii*) make stand improvement cuttings very difficult. Recent research has shown that, when the cut stumps of the hardwoods were treated with a one percent water solution of the isopropyl ester of 2,4-D with half-a-pint (0.28 l.) of solution on stumps under 6 inches (15.24 cm.) in diameter and one pint (0.57 l.) on larger stumps, the sprouting of tan oak stumps was reduced to 64 percent, the sprouting of madrone stumps was reduced from 36 percent to 28 percent, and the number of sprouts per sprouting stump was reduced to about one-third. Treatment in midsummer seems to be best to prevent sprouting of the madrone, and in late fall or early spring for tan oak.

• In the Lake States, natural stands of young red pine (*Pinus resinosa* Air.) are often overdense, from 5,000 to 20,000 stems per acre, (18,355 to 49,420 per ha.), and the question of desirable spacing to be attained by thinning in such stands has been studied by the Forest Experiment Station for a quarter of a century. The main conclusions are that for stands of from 20 to 40 years old, an average of not rigidly applied spacing from 1/4 to 1/5 the height of the stands is desirable, and for older stands, an average spacing of a little less than 1/5 the average dominant height. In plantations on average sites, a spacing of 7 × 7 ft. (2.1336 m. × 2.1336 m.) will give desirable stocking at the time when the first commercial thinning for pulpwood is made. On better sites, the number of trees should be less and, on poorer sites, more. Determination of spacing in relation to stand height is simple and desirable, since the stand height is an indication of site quality and stand age. In thinning, the most valuable trees should be retained, even though resultant spacing is not completely regular.

• In the pine and mixed conifer forests of the Sierra Nevada mountains in California, previous methods of silviculture have not been effective in providing adequate restocking of pine. The most commonly used method of cutting has been by tree selection, depending on classification of the individual tree, and much weight has been given to taking out tree classes of high risk and leaving low risk trees, that is, those which can be expected to survive at least during the calculated cutting cycle. Analysis of 40 years of research and experience has now led to the conclusion that a new concept is needed, and this is called "unit area control."

It depends on identifying the often small and irregularly shaped patches of timber in the forest each of which has its own characteristics, and each of which will, in cutting, be given treatment specifically adapted to its own problems. The classification involves, first, the recognition of silvical characteristics. The sugar pine (*Pinus lambertiana*) and ponderosa pine, for example, are intolerant and grow best in even-aged groups, prefer bare mineral soil for germination, grow rapidly if they start free of competition and need thinnings and cleanings for best growth; they do not establish themselves as rapidly under competing cover and, where they do, grow poorly; they do not prune themselves naturally. Moreover, pine seeds are the favorite food of numerous rodents. Classification of stand conditions includes determining the age group of the overstory, the species to which the unit area is best adapted, the degree of stocking, the availability of suitable seed trees, and the presence or absence of brush or other competing vegetation. Cutting may have one of several primary purposes, which include cutting for natural restocking, where suitable seed trees are present and when a seed crop is on the trees; cutting for artificial restocking, where seed trees are absent or no seed crop is visible; cutting for release, where advance growth is already established and cutting for improvement of young saleable stands to remove old malformed or defective trees. In the first two categories the unit is clear-cut, slash is piled and burned, competing vegetation is eradicated, and the bare mineral soil is exposed. In applying unit area control, it is necessary to have, first, a detailed inventory so that the amount to be cut can be correctly estimated and a management plan can be prepared. Short cutting cycles are desirable in order to maintain full control of the stand and to convert the old growth into a regulated forest. Problems of logging are no different from those with other systems of cutting, but it is particularly important to minimize logging damage to reserve trees and established young growth. Application of the new method, which was devised after many years of research, will, in fact, speed the effective conversion of old growth forest to managed forests, and will result in more complete use of the growing capacity of often highly productive forest soils.

Logging and Engineering

United States of America

• In the State of Oregon, the method of log transportation has changed in the past 20 years from water or rail to the almost exclusive use of logging trucks, due to the fact that the timber now used is farther away from rivers and can be reached only by maximum grades greatly in excess of those suitable for railroads; thus the wide dispersal of timber ownership makes it necessary to operate, in many cases, in relatively small tracts of timber. This development has resulted in utilizing many stands which were formerly marginal and in increased utilization amounting to as much as 25 percent of the timber opened up.

Recent studies have been made of the costs of log transport on different type roads, with different speed limits and with different truck loadings, and of the amount of timber which will be hauled over each of the numerous existing highways during the next 10 years. These data are expected to provide a sound basis for determining priorities and scheduling work on highways in the interests of resource utilization. The cost per thousand board measure of logs per round trip mile decreases, for example, from $0.24 to $0.19 on 20-mile (32 km.) per hour gravel surface roads when the gross vehicle weight increases from 50-60,000 lb. (23-27,000 kg.) to 60-80,000 lb. (27-36,000 kg.). Further additions to vehicle weight either reduce the cost slightly or, with very heavy vehicles, increase it. Cost for 60-80,000 lb. (27-36,000 kg.) vehicle weights are $0.15 on 30-mile (48 km.) per hour gravel surface roads and $0.12 on 30-mile (48 km.) per hour concrete surfaces — all the figures based on an average haul of 30 miles (48 km.). In view of the continuing importance of truck transport of logs, and of the known economies of operation, the timber industry organization making this study recommends an increase in legal weight limit to a total vehicle load of 72,000 lb. (33,000 kg.) and an axle load of up to 18,000 lb. (8,000 kg.)

Forest Injuries and Protection

Canada

• Recent experiments in poisoning the Deer mouse (*Peromyscus*), which is one of the main obstacles to successful reforestation by direct seeding, have been conducted in British Columbia utilizing the new poison, sodium fluoro-acetate, commonly known as "compound 1080." Effectiveness was determined by trapping on sample plots before and after the poisoning operation, which was conducted in early spring and involved broadcasting poisoned bait at the rate of one tablespoonful on every 50 feet (15 m.) of the surveyed lines. It was found that although the rodent population was heavily reduced — and that this reduction extended well beyond the date that germination of seed might be expected — by the fall the rodent population had been measurably re-established through infiltration and by breeding of the surviving mice. There was no evidence, however, that desirable birds or animals were destroyed. The poisoning was followed by seeding to Douglas fir. It was over three times as effective as the work conducted on the control plot.

• Through the co-operation of the Post Office Department, the Forestry Branch has been permitted to use the services of the postal cancellation machines to carry a brief forest fire prevention message during the spring and fall fire season on all letters from key post offices throughout Canada. The Post Office Department has further co-operated with the Forestry Branch by providing space in all Post Office lobbies in Canada to display forest fire prevention notices during the dangerous fire season.

New Zealand

• In New Zealand the problem of the interactions of forests and alien animals is receiving much attention, both on the part of foresters and others. The National Forest Survey is systematically recording information on the effects of deer upon indigenous forests and, although the Survey is not completed, enough information has been accumulated to publish partial analyses. Broad generalizations on the relationships are impossible because so many variables determine the degree and kind of damage; for example, the period of development of the deer population itself is important. After deer are established, there is a period of rapid population growth during which preferred foot plants are eaten out, which may or may not result in detriment to the forests. Then, in the absence of heavy culling of the herd, a period of overpopulation follows during which the food habits change rapidly and the most noticeable damage to the forests occurs. This is followed by a downward readjustment of herd population during which much of the damage is repaired, but the browsing of desirable forest species by a relatively stabilized population continues.

The indigenous forests themselves have changed in composition in the recent past, and in some areas are still changing. Displacement of the podocarp forests by silver beech and of the latter by mountain beech, while irregular, is a widespread process of ecological change. Thus the forest-deer relationship depends on both the stage of forest evolution and on the stage of herd development. Culling of the herds by hunting which, in some areas, has been very heavy, is a further factor to be considered. If done during the period of population increase, it merely prolongs this period. If done during the period of over-population, it tends to shorten this period and the period of normal recovery. Culling of stable herds is beneficial only if carried out systematically each year, since otherwise herds strengthen and recover. A true measure of culling is the percentage reduction accomplished, not a mere statement of the number of animals taken, and methods of compiling inventories have not been fully worked out.

Studies so far made in the Western Southland have served to identify

the plants most commonly browsed and those which are never browsed. In addition, studies have been made on six forest types of podocarp forest, silver beech, mountain beech and mixed forests to determine the effect of deer grazing on each and to estimate future development if deer grazing continues. Here, as elsewhere in the country, it is evident that the correct relation between forest and deer depends on the factors in each situation. In some cases, where desirable tree seedlings are heavily used, the best action in terms of forest values may range from extermination of deer herds to maintenance of large populations. Since the studies are being made with full undertanding that deer and other animals such as opossum are now integral parts of the forest estate, and since particular situations are being studied on a thoroughly factual basis, it is to be expected that the eventual outcome, when the survey and special studies are completed, will be the development of definite plans of management.

A recent book entitled "Introduced Mammals of New Zealand" has accumulated and analyzed the available information and, although not attempting broad generalizations, it is expected to provide a useful source of information for students of the subject.

Norway

• Operating in Norway since 1912 the Norwegian Mutual Forest Fire Insurance Company has now insured 80 percent of the private forest value in Norway. Compensation is paid for damage to the forest floor and to young stands not yet merchantable. As fire-killed timber of dimensions larger than about 8 in. (20 cm.) diameter at breast height can be readily disposed of without much loss in stumpage, insurance is normally effected up to the limit of nonmerchantable D.B.H., and further, in Norway, the value of larger trees is not seriously affected by fire. Insurance rates are low and since its inception the Company has built up satisfactory reserves. From the outset it was realized that protection of the forest from fire was the essence of forest fire insurance. Laws were enacted and a modern system of detection and suppression established.

United States of America

• For five days beginning August 18, 1951, lightning storms started fires on national forest and state-protected areas in Northern California, Oregon and Washington. The earlier storms were largely dry, and many of the resulting fires made fast starts. Thus immediately available suppression forces were committed early, and the problem of manning later fires became unusually difficult. On the California National Forests a total of over 500 separate fires occurred during these five days and, with the additional large numbers over other areas, it is evident that this is one of the major lightning fire concentrations in the 50 years of organized protection on the West Coast.

Unusual steps were taken to man fires as they were discovered or spread. Skilled personnel were shifted by plane from unaffected regions, organized Indian crews were brought in by plane from the southwest, crews of state prisoners were moved to major fires by truck and bus, and lumber companies released woods and mill employees. Smoke-jumper crews were moved from the northern Rocky Mountain region and elsewhere to selected local headquarters. On the fifth day smoke from the fires was so dense as to form continuous blankets over part of the affected area, making air operations impossible and reducing the chances of detecting new fires. Small crews of selected men were then dispatched to patrol individual drainages and to detect and suppress the incipient fires thus discovered.

Despite the unusual and severe difficulties, by the end of the fifth day there remained only five fires ranging in size from 1,000 to 8,000 acres (400-3,240 ha.), on which suppression work was under way but not yet completed. In former major lightning fire concentrations of this order, the number of fires remaining uncontrolled after so short a period has been much larger and the area burned over much greater, due to the then unsolved problems of rapidly mobilizing competent additional help from outside the affected area.

• Blister rust control work in the western states of Washington, Oregon, California, Montana and Idaho, is assisted by the U.S. Forest Service, the National Park Service, the U.S. Bureau of Land Management, the U. S. Bureau of Entomology and Plant Quarantine, the State of California, and by two lumber companies. In 1950, $1,290,000 were spent, control work was done on over 121,000 acres, (49,000 ha.), pine surveys to determine whether lands are to be treated were done on nearly 147,000 acres (59,000 ha.) of private lands and on a large area of national forest land, ribes surveys were made on nearly 230,000 acres (93,000 ha.), and disease surveys were made on over 13,000 acres (5,000 ha.). In general, rust on ribes was light throughout the western white pine (*Pinus strobus*) and sugar pine (*P. lambertiana*) region, and while the rust is spreading from previously known infection centers, there is no evidence of long distance spread to new centers.

Much of the control and survey work is now contracted rather than done by agency crews and this is apparently reducing costs. There is a wider use of chemicals for destroying ribes and the long-term program of research in this field is being continued. Nearly 800 sample plots have been laid out during the past few years to study the effectiveness and cost of (1) mixtures of 2,4-D and 2,4,5,-T, (2) mixtures of 2,4-D with chemicals other than 2,4,5-T, both applied as dilute aqueous (relatively high volume) sprays, mist concentrate (low volume sprays) with oil or water base, and basal stem treatments — all applied to several species of ribes. In addition, a comprehensive research program dealing with physical and chemical methods of eradication and with ribes ecology in relation to control work and white pine management is under way. A great many sample plots are under observation to determine effectiveness of control, relation of different degrees of logging and of fire to germination of dormant seed and similar questions.

• Exploratory surveys of the role of forest pathology in future forest practice have been conducted for a number of years in Alaska, covering both the coast forests and those of the interior. A great many species of damaging fungi have been identified and their places of occurrence in different forest types and zones have been at least partly worked out. Many of the organisms are circumpolar in distribution and included in the group are several species which, while not notably damaging in virgin forests, may cause damaging epidemics in disturbed forests, that is, those logged or burned over. Many of the forest species are subject to wood-destroying fungi and, since the loss of heartwood begins at relatively small tree size, it is probable that forest management will have to work on a basis of better utilization of defective material than by attempting to cut it by pathological rotation.

In general, it is evident that disturbance of the forest by fire and logging commonly leads to epidemics of destructive diseases, and thus great care and continuing study of the problem are necessary. It would be desirable to reserve areas of virgin forest in the different types and zones so that the studies in forest pathology may go ahead concurrently with the programs of utilizing the great forests of Alaska which are now being undertaken.

Union of Soviet Socialist Republics

• The Ministry of Forestry, in its report which appeared in January 1951 on the progress of forestry during the five-year period 1946-1950, states that there has been a marked improvement in reducing forest fires. If 1947 is taken as the base year, 39, 61 and 50 percent of the area was burned over in 1948, 1949 and 1950 respectively. Forest fires, however, still continue to cause great losses to the national economy, and the fight against them continues to be the Ministry's most important task. The following are among the fire control measures adopted. (1) On the basis of the close relationship between meteorological factors and inflammability calculated by Prof. V.G.

Nestorov, long and short term prognoses of the approaching dangerous fire conditions are distributed to forest administrative units throughout the country. (2) Aerial patrol for speedy detection of incipient forest fires is widely used. Over a large area of northern European Russia, Siberia, and the Far East this is the only available means of discovering and locating forest fires. (3) The use of aviation in actual fire suppression. Specially trained firemen are dropped from airplanes either direct to the source of the fire or at the nearest settlement. In the former case they try to extinguish the fire by their own efforts; in the latter, they organize the local population for fire fighting. (4) Within recent years, liquid solutions of different chemicals have been widely used either for extinguishing fires directly or for creating fire-proof lanes to obstruct the spread of fires. The chemicals most commonly used are calcium chloride, magnesium chloride, ammonium phosphate, ammonium sulphate and similar fire extinguishing chemicals. To facilitate the use of chemicals in fire suppression some 400 so-called "chemical stations" have been established. At each station there is usually a crew of 6 - 8 men, equipped with knapsack sprayers or pumps. (5) The forest communication system has been extended. From 1947 to 1950 some 5,000 km. (3,000 miles) of telephone wires were strung, 2,400 telephones installed, and 527 radio stations put into operation. In 1951 an additional 3,000 km. (1,200 miles) of telephone wires are to be strung and 200 more stations set up.

• Considerable progress has been made during the last five years in controlling insect damage and the diseases of forest trees. The maintenance of a minimum of sanitary conditions has been made obligatory for all forest of the U.S.S.R. Stress has been laid on the importance of observations over a wide area on the health conditions of the forest, a system has been devised for reporting promptly the appearance of serious damage by insects and diseases, continuous stationary observations have been instituted on the most dangerous insects and diseases and a series of preventive and exterminative measures applied. The work was carried on most intensively in the forest plantations of the prairies. During four years (1947-1950) forest pathological reconnaissance covered more than 10 million hectares (25 million acres); aerial reconnaissance, with checks on the ground, extended over an area of 26 million hectares (64 million acres); and preventive and exterminative measures were applied to more than 1.3 million hectares (3.2 million acres). Aerial reconnaissance and the use of poisonous chemicals became very common. Of the chemicals, DDT and benzene hexachloride were found most effective in combating insects either by dusting from the air or by application on the ground. The latter treatment proved especially successful in combating insects attacking the roots of trees, resulting in a high survival of trees planted in soils infested with June bugs and similar insects. At present a great deal of attention is being given to finding effective means of protecting acorns and seed of various species of trees and shrubs from attacks by insects or disease.

Measuration and Surveying

United States of America

• Recent research dealing with hardwood stands in the Central States indicates that reasonably effective volume tables can be constructed from aerial survey data whereby the total per acre volume can be determined with satisfactory accuracy. Volume per acre depends on correlation of crown diameter, average stand height, and percentage of crown cover, and may be expressed either as board feet or cubic feet. The measurement or estimation of these variables from photographs is subject to variations, depending on the observer, but these individual variations can be adjusted. The tables reflect average conditions over wide areas and give the total volume of all species, since it is impractical to determine species from photographs. Thus, adjustments in the general tables are necessary for local use, but these can be made much more economically than constructing new tables.

The great advantage of the tables is that they give approximate volumes from aerial photographs with little or no ground work. Thus for certain types of inventory, their use seems to offer a chance for speedier and less costly work than before.

• The traditional method of measuring National Forest timber sold to operators has been by scaling on individual logs. This is not only costly, but is unproductive in that it diverts skilled manpower from the essential job of supervising sales and seeing that needless damage to residual stands and young growth is avoided and that other protective measures are carried out. The current expansion in timber business on National Forests, and the increasing difficulty of obtaining appropriations to hire competent officers needed by traditional methods, has emphasized the need for less expensive methods of measuring the volume of timber cut in a satisfactory way.

One such method — determination of volume by sample tree measurement — has recently been studied in the Northern Rocky Mountain region. The starting point is the fact that good silvicultural practice demands that each tree to be cut shall be individually marked and therefore a competent officer must go over the area in any event. The plan depends on a system of sample tree measurement done concurrently with the marking. The cost of marking averages 8 cents per tree, the cost of measuring a selected sample number of trees is about 12 cents per tree, and the saving by sampling is estimated at about 10 cents per tree.

The size of the sample to be taken depends on the accuracy desired, the amount of variation in tree volumes from the average, and the degree of stratified sampling — that is, the breaking down of the total population into two or more general size classes. The accuracy desired depends both on the stumpage rate paid, already high and getting higher, and on the degree to which individual purchasers are prepared to accept inevitable variations in volume as determined by sample trees in comparison with log scaling. The seller can consider that his interests are protected by the averaging out of a large number of sales, but the purchaser naturally is not interested if an overscale on his sale is offset by an underscale somewhere else. The variation of tree volume expressed as a co-efficient of variation can be determined by well-known methods or by the simpler process of the judgment of experienced officers.

The number of trees required in an adequate sample increases at more than an arithmetic ratio as accuracy standards increase and as the total number of trees to be cut increases, and the sale officer can thus determine how many sample trees will be required. The individual bias in selecting sample trees is offset by stratified sampling in which the large trees which contain a high percentage of the volume will have a higher percentage measured as samples than medium size and small trees. Then some system for random selection of trees to be sampled needs to be enforced. A further element of inaccuracy arises from the errors in existing volume tables when used for particular local stands, and until form class volume tables are used, this cannot be wholly overcome. But experienced officers can make adjustments if they know the basis on which the tables were constructed.

As when scaling individual logs, some check of the results will be necessary, but from the standpoint of the seller the method of sample tree measurement as worked out in detail in this region is practical, economical and accurate.

Forest Management

United States of America

• The Pacific Northwest Forest and Range Experiment Station has carried on an extended research project in applied forest management in the Douglas fir (*Pseudotsuga taxifolia*) region. Practices that appear promising are tried out on commercial scale experimental logging operations in co-operation with both private and national forest managers. The

small-scale sample plots which have been under observation for more than 30 years have given many promising leads, but show above all that there is no one best method for the process of changing old virgin forests into thrifty managed forests, because of the great variety of stand, site, ground cover and topographic conditions. On the contrary, flexible combinations of staggered setting, clear-cutting, and partial cutting by tree selection must be worked out in relation to specific conditions. The main objectives sought in clear-cuttings and the techniques by which they may be reached included : (1) harvesting the mature crop with the most effective possible utilization ; (2) providing abundant seed for regeneration ; (3) providing favorable seed bed ; (4) obtaining optimum species composition in new forests ; (5) avoiding creation of excessive fire hazard ; (6) minimizing windfall loss in the remaining stands ; (7) avoiding severe erosion and maintaining favorable watershed conditions. Although the results of many partial cuttings by tree selection have repeatedly been unsuccessful, there is a place for such cuttings when made on a stand improvement for example, by harvesting low vigor trees and by making a cut of not more than 30 percent of the standing volume, by returning fairly frequently to cut additional volume as conditions justify. The principal steps in applied management research are, first, an inventory and silvicultural analysis of the specific areas, then topographic mapping, study of ground conditions, classification into areas to be logged by different methods, preparation of a road and logging plan, and finally, the marking out of the plan on the ground to make final adjustments in the location of roads, landings, cutting boundaries, and timber to be removed by tree selection.

Union of Soviet Socialist Republics

• Wages of workers in forest operations are based on piece work or according to the job with progressive bonuses for work in excess of the agreed standards. In forest planting operations, for instance, bonuses are paid in excess of the regular wage depending on the percentage survival of trees in the plantations after the first, second and third year after planting. By this system of payments, the Ministry of Forestry claims that the average level of efficiency of the forest workers has been markedly increased. Thus when the Ministry of Forestry was first created the average efficiency of the forest worker was 90.6 percent of the fixed norm, at the end of 1947 it rose to 97 percent, in 1948 to 104 percent, in 1949 to 106 percent and in 1950 it reached 107 percent.

Marketing and Trade

United Kingdom

• The Timber Development Association, Ltd., has summarized information available on the economics of the substitution of other materials for timber. Timber imports have been drastically cut in recent years, due to a stringency in foreign exchange rather than to a shortage of world supplies of timber. At the same time, the importance of coal and steel to the country's industry and credit cannot be exaggerated and, although the relation of these materials to timber is not always obvious, the relation exists. Deficiencies of timber imports have been met by rigid economy in : (1) refinement of design and elimination of wasteful forms of construction ; (2) prohibition of use of timber for non-essential purposes ; and (3) use of substitute materials. The limits of development of (1) and (2) have probably been reached.

Steel has been used as a substitute for timber, and is generally more expensive than the timber it is used to replace. For example, wooden window-frames of an ordinary house cost about £ 18 and steel windows about £ 24. An annual saving of at least £ 500,000 a year could have been made by use of wood instead of steel. If the 50,000 tons of steel used in the manufacture of metal doors and windows had been exported to dollar countries, the sale would have produced about £ 5,000,000 worth of dollars, and imported timber to replace the products would have cost less than £ 1,000,000 worth of dollars. Steel is the country's most precious material asset, and conserving it for export is of the greatest importance. American and British construction experience shows that, in many types of structural assembly, a ton of timber will do about 15 percent more than a ton of steel, and the cost per ton of imported timber for such uses is much less than the equivalent value of steel.

Cement has been used as a substitute, and official efforts have been made in the production of pre-stressed concrete joists which involve the building of special plants and therefore the use of scarce materials and labor. Ordinary reinforced concrete is about 5 times as heavy as timber members of the same strength and even pre-stressed is about twice as heavy. Pre-stressed concrete sleepers cost about double the price of timber.

The total demand for cement can at the moment only be met by imports. Coal is a limiting factor in the reconstruction of British industry, and studies show a consumption per sq. yd. of 1.70 cwt. (190 lb.) for steel framing covered with asbestos-cement sheeting ; 0.56 cwt. (63 lb.) for pre-cast concrete flat slab ; 0.45 cwt. (50 lb.) for "in situ" concrete flat slab ; 0.40 cwt. (45 lb.) for timber framing and tiles ; and consumption of timber framing and shingles or boarding is nil. The substitution of timber for steel for domestic uses would indirectly increase the amount of coking coal available.

Aluminum has also been used in place of timber ; it is imported from Canada at a far greater cost than timber, and in finished form is very much more expensive.

Studies have been made of the use of steel and softwoods in experimental non-traditional type houses in Scotland. These show a use of steel ranging up to 8 tons per dwelling, compared with $^1/_4$ ton in the pre-war traditional house. Of the 20 experimental types studied, 14 used one ton or more of steel. In the traditional house, 2.5 standards of softwood were used. Of the experimental types, 13 used 1.5 or more standards. Grants paid for non-traditional houses have been from £ 70 to £ 785 per dwelling, with none on traditional type houses. The use of substitute materials is one of the most important causes of increased building costs.

A list of the more common items in which steel and concrete have been substituted for timber shows 128 specific items, taken from all types of building, civil engineering and transport activities, as well as furniture and allied trades.

Conclusions are : (1) that, it is necessary not only to reverse the policy of using substitutes for timber, but to extend the use of timber to new applications which, in the past, have been reserved for steel, reinforced concrete and aluminum ; (2) British industry can only be restored by increased production of coal and steel, and the most wide-spread use of timber instead of these vital materials will not only reduce imports but will increase exports, save manpower, and reduce the cost of living.

Forest Products and their Utilization

Belgian Congo

• Since it has become known that mixtures of forest species can be pulped to produce various kinds of paper, practical ways of organizing pulp manufacture have been under investigation. Similarly the preparation of pulp from papyrus which extends over enormous areas in the region of the Kisale Lakes, has been examined, and a syndicate has been set up to study the cultivation of papyrus in the Belgian Congo.

A body of Belgian financiers is particularly interested in the production of wood cellulose, with the help of an American agency and with the support of the authorities. The possibilities for pulp are virtually unlimited, and the installation of several factories in the Belgian Congo is contemplated.

Canada

• A Canadian report to FAO states that the relation, previously established, between the density of wood and its dielectric properties has been confirmed. This information is of value in the industrial application of dielectric heating to the edge-gluing of lumber. It serves in determining optimum glue spread, power requirements, and the durability of joints made by this process. Development of a method for measuring the radio-frequency energy expended in a gluing operation is an important advance, as it will have a direct influence upon the application of the dielectric technique to industrial gluing problems.

• Canada and the United States import 99 and 85 percent respectively of their vegetable tannin requirements, largely Quebracho which now commands an almost prohibitive price. The American chestnut, (*Castanea dentata*), formerly a large source of supply, has been largely eliminated by blight disease. One alternative source is the bark of western hemlock (*Tsuga heterophylla*) which could, if fully utilized, more than fill requirements.

Most hemlock logs on the west coast are floated on ocean water and, since the bark absorbs salt, it has been questionable whether such bark could be utilized. A recent study of this question has been made by the Forest Products Laboratory of Vancouver. It was found that: (1) Hydraulic barking is the most advantageous process of bark removal since the bark is relatively free of wood and the barking process removes a considerable amount of salt. (2) The tannin content of bark from seawater floated hemlock logs is roughly proportional to the time spent in the water. (3) The rate of loss of tannin from floated logs is about the same in fresh and salt water and is at the rate of 5 to 10 percent per month. The bark acquires the major part of its salt content during the first month. (4) A laboratory method has been devised for ion-exchange treatment which successfully prepares the bark for tanning good sole leather. (5) Results of the laboratory work merit investigation in a pilot plant.

United States of America

• The U.S. Bureau of Agricultural and Industrial Chemistry, co-operating with industry, has developed a box board made from straw which can replace wood veneer generally used in making wire-bound shipping containers. As much as 1,500,000 million sq.ft. (139,350 million m^2) of wood veneer is used annually for wire-bound boxes, and 500,000 tons of straw, would replace the wood. The process uses standard equipment, and the thickness of the board can be varied from $^1/_6$ to $^1/_4$ in. (0.4-0.6 cm.). The problem of cutting the straw board by wires was solved by putting a metal edging on the board. Straw board boxes withstood the standard handling tests.

• The Yale School of Forestry recently released information on the gluing properties of 29 species of tropical American woods as part of the program on tropical woods conducted in co-operation with the Office of Naval Research. In addition, Burma teak and American white oak were tested as standards of comparison. Standard procedures are used in selecting materials for testing, preparing them, and in the gluing procedure followed on the instructions of adhesive manufacturers, and in testing procedures on the sample blocks. Results given for each species include the specific gravity on an oven-dry basis, moisture content, actual strength in pounds per square inch, and percent of wood failure. Several adhesives were tested, all of which are equally satisfactory. Of the species tested, 21 are classified as easy to glue; nine require special care in the gluing operation; and one, lignum vitae, requires special preparatory surface treatment for gluing.

• No economical means have yet been developed for efficient utilization of unavoidable waste produced in the manufacture of redwood lumber, although the existence of chemical constituents which render the wood resistant to decay indicates that they could be valuable as preservatives and insecticides, and the high phenolic content indicates the possibility of isolating raw materials for the production of phenolic resins.

The Stanford Research Institute has conducted a preliminary evaluation of the possible extractives. Mill waste is rendered susceptible to saccharification by hogging the waste, pre-steaming and extraction with water and with dilute caustic. The extract thus obtained contains various recoverable chemicals of a phenolic nature, including furfural, phenolics, neutral oils, charcoal, gypsum and lignin, the latter yielding 562 lbs. per dry-ton of waste (approx. 281 Kg. per m.t.) Destructive distillation of the extract, solids and lignin residues would be required to recover the available chemicals. Indications are that total recovery, including sugar, might have a market value of nearly $ 20.00 per dry ton.

Forest Policy

Czechoslovakia

• In 1948 the Czech Government completed and fulfilled its two-year plan to the extent of 105.9 percent. In 1949, it entered on its first five-year plan (1949-53). The nationalized wood-using industry is now said to comprise 744 plants of every description and employs 56,000 workers and other personnel. The industry is supplied principally by domestic raw materials. According to the latest official statistics (1948) one-third of the entire Czech Republic, or about 4 million hectares (10 million acres) is covered with forests. Conifers (spruce) predominate, occupying 46 percent of the total forest area, hardwoods (chiefly oak and beech) 26 percent, mixed forests 13.6 percent, and the remainder (shrubs) 14.4 percent. The average volume of timber cut each year is about 11 million m^3 (388 million cu.ft.); of this 73 percent is softwood and 27 percent hardwood timber. It is evidently intended to maintain this average, since during the five-year period it is planned to cut only 55.18 million m^3 (1,948 cu.ft.) of timber made up as follows: 27.2 million m^3 of round logs, 1.8 million m^3 of railroad ties, 3.4 million m^3 of mining timber, 8.8 million m^3 of pulpwood, 1.3 million m^3 of other constructional timber and 12.68 million m^3 of firewood. The wood-using industry hopes to increase its output by 30 percent over that of 1948 and 48 percent over the prewar output, not by increasing the total cut, but by more rational utilization of production. The cut is to remain not only within the limits of growth, but some 231,000 hectares (570,801 acres) of new land are to be brought into forest cultivation by 1953.

The character of the products now put on the market differs substantially from that of previous years. Sawmilling is assuming an important role. In 1949, for instance, sawmills delivered 3,165,000 m^3 of sawn lumber and ties. The manufacture of veneer is being stepped up as shown by the following figures:

	1947	1948	1949	1953 (estimated)
Veneer glued in 1,000 m^3	50.0	70.9	84.1	111.5
Veneer not glued in 1,000 m^3	6.485	11.279	—	15.200

Furniture-making features prominently in the five-year plan owing to the great abundace in Czech forests of beech, which is particularly suited to this industry. Another new industry is the manufacture of pre-fabricated houses and other structural parts as a means of meeting the housing shortage. Efforts are being made to bring wood-using industries to the more remote and economically less developed regions of the country.

New Zealand

• The Government set up a Tax Committee of Enquiry early in 1951, and the Forest Service, which has been greatly concerned over the unsatisfactory state of forest taxation, brought this subject to the Committee's attention. As a result, the Committee now considers the subject of forest taxation so important that it has set up a special Sub-Committee to investigate and report in detail. It is hoped that as a result of this enquiry the remaining anomalies in forest taxation will be abolished.

UNION OF SOVIET SOCIALIST REPUBLICS

• The U.S.S.R. has set aside a large forest area as "protection forests" — an area, it is claimed, as large as the entire forested area of western Europe excluding Scandinavia. The regulations for the management of these "protection forests" are very rigid. Only sanitary cuttings, i.e. removal of dying and diseased trees, are allowed; and thinning and cultural operations tending towards converting pure conifer stands into mixed stands, and one-storey forest into two or three-storeyed forests. All clearings in the forest must be planted up. The practical and silvicultural value of these regulations is now seriously questioned, especially the elimination of commercial cuttings, as this leads to a large accumulation of overmature trees. At a particular age these trees begin to deteriorate; the stands thin out ond lose their protective importance, the overmature trees become easy prey to insect and fungus infestations and it often becomes necessary to cut out entire stands and resort to replanting, thus defeating the purpose intended. In addition, by eliminating commercial cuttings, the creation of mixed many-storeyed stands is hampered. Important economic considerations, therefore, weigh heavily against the elimination of commercial cuttings in "protection forests."

By eliminating commercial cuttings the country loses between 20-30 million m^3 of structural timber each year in the form of annual growth. Sanitary cuttings remove only a small percentage of this annual growth and such timber has already lost much of its value. For these reasons there is a growing demand that commercial cuttings of mature timber be allowed in "protection forests" — not clear cuttings, but gradual selective cuttings.

Reviews

It is the policy of FAO to review here only selected publications which appear to have a direct bearing on the current work of the Forestry Division.

THE SELECTION OF TREE SPECIES. Mark L. Anderson. 151 pp. Oliver & Boyd, Edinburgh and London. 1950. 12s. 6d.

In the British Isles, planting site conditions are extremely varied and complicated and, despite a large number of publications dealing with tree planting, no relatively objective practical means of distinguishing and classifying plantable site-types has been devised to serve both as an aid in the choice of tree species, and as a basis upon which to build sound silvicultural practice. Many ecological studies of vegetation types and of remnant native forest types have been made, but have not been reduced to practical form.

The current publication has been written to fill this gap and help avoid future mistakes and disappointments. The author has had 30 years' experience, during the last 18 of which he has tested on a large scale his earlier conclusions on classification of sites and on selection of the species most suitable for each type. Although dealing specifically with British conditions and problems, the methods developed are correctly believed to be adaptable to a scientific analysis of planting conditions and problems in other countries.

Many mistakes arise from making decisions on the basis of the theoretical yields in volume and value which appear to be obtainable from various species. However, the only safe basis for selection of species is the purely ecological one, and it is to this that the author mainly directs his attention. The planting area needs first to be studied carefully from several standpoints: the general and local climatic conditions; the general configuration of the ground and local topography and soil variations; and the inhibitory biotic factors such as the liability to damage by harmful animal and plant agencies, including mammals, insects and fungi. A simple method of forest site classification is needed in order to facilitate understanding of the site requirements of indigenous species, of the reasons for success or failure of introduced or biotic species; to avoid using species on sites to which they are unsuited; to make safe comparisons between widely separated stands and localities and to relate treeless to tree-clad areas. Both direct and indirect methods must be used in assessing localities. Study and classification of the ground vegetation which reflects conditions of the site are important. More specifically, these conditions are soil fertility and soil moisture. The author sets up an arbitrary six degrees of soil fertility, each of which is subdivided into dry, moist and wet, thus giving a total of 18 site classes or locality units. Each of these has an identifying and identifiable type of subordinate plant community.

Having characterized the locality, it is next necessary to determine the species suitable for planting. It is advisable to avoid widespread use of exotic species which have not yet had a sufficiently long period of testing to determine fully their worth or adaptability. There are, however, 27 broadleaved and 23 coniferous species which qualify for consideration. In the selection, not only the site conditions but the use of the species must be taken into account — that is, whether they are valuable primarily for timber, for soil improvement, for nurse crops, or for storm resistance, *e.g.* as shelterbelts.

A knowledge of the natural forest types is important because of the indications it gives of local variation and of the tree species adapted to given sites. There are 15 main natural indigenous forest types.

In making the final selection, it is necessary to have accurate information about each species, covering its range and importance, ecology, qualities and uses as timber, results obtained in plantings, scope for use in planting, techniques of seed collection and storage, nursery treatment and methods of planting. One of the most valuable parts of the book is the compact analysis of each of the 50 species which is given along these lines. The author's general conclusions on each species summarize the pertinent information and, in some cases, for example the indigenous sessile oak (*Quercus sessiliflora*) indicates a little used species which deserves far greater attention. Combining the separate analyses of sites and of available species, the author presents in tabular form a list of the species suited to each of the 18 site classes, and further subdivides them into hardy and tender species.

The final process of selection is to determine what species for a particular site class may be expected to reach productive maturity and to maintain or improve the fertility of the soil. The second step is then to determine which species having these characteristics is most likely to produce the greatest value over the calculated rotation. Finally, the author summarizes for each of the 18 site classes the characteristic problems encountered in planting, such as the ease or difficulty of clearing and draining, the need for nurse crops, and the like.

This publication should prove exceedingly useful to foresters in the British Isles, in addition to serving as a model for similar work elsewhere.

GEOGRAPHY OF RUSSIA. N.T. Mirov. 362 pp. John Wiley & Sons, Inc. New York. 1951. U.S.$ 6.50.

Russia covers about one-sixth of the earth's land surface, excluding the Antarctic, and measures about 3,000 miles (4,800 km.) from north to south and 7,000 miles (11,300 km.) from east to west. Within this vast

area there is wide diversity in climate topography, soils, land use, and peoples. An extensive literature on the geography of the country as a whole and of its several parts has been produced by professional Russian geographers, but this is rarely available to students in English-speaking countries. The mere problem of translation with a sufficient degree of accuracy is a real barrier to obtaining correct information. The present book is prepared from Russian sources by a Russian who has done scientific work both in Russia and in the United States, who has a wide personal knowledge of geographic conditions in many parts of Russia, and who, as a forester, is particularly aware of the natural features and natural zones and types encountered when describing the geography of the country.

A general picture of the geology, topography, climate, rivers and lakes of the country, and of the peoples, languages and religion, is followed by an account of the geographic regions, following the classification usually accepted by the Russians. These are : the tundra, the coniferous forest belt, the region of mixed forests, and the woodland, prairie, semidesert and desert regions. Each of these broad natural latitudinal zones differs from the others, and each possess s its own characteristic climate, soil and vegetation. The mountainous regions are more difficult to characterize because of their heterogeneous composition and because of less thorough scientific exploration. For each of the major regions, information is given on climate — particularly temperature and precipitation; topography; soils and vegetation, including forest types to be found there ; animal life; and the peoples who live in the region and their principal occupations. In discussing the forest regions, no attempt is made to estimate areas, or give other information about the forests and their use and exploitation.

Similar information is given for a number of other regions, for example, the mountains of central Asia ; the Caucasus ; the Carpathian Mountains ; the Crimea ; the Ural Mountains ; the Altai System and Kuznetsk Basin ; the Sayan Mountains and Tuva Region ; the Transbaikal Region ; the mountains of Northeastern Siberia; the Far Eastern region; the Okhotsk Coast and the Island of Sakhalin; the Peninsula of Kamchatka and neighboring i lands and the islands of the Arctic.

While the book is addressed primarily to students of geography and to the general reader, it should be of real interest to foresters for the comprehensive picture it gives of the species, types, condition of the forests, and destructive forces at work on them. Moreover, within the scope of a single volume it makes considerable factual material available to English-speaking people.

Technologie des Holzes und der Holzwerkstoffe. Prof. Dr. Ing. Franz Kollmann. 1050 pp., 870 figs., 190 tables. Springer Verlag, Berlin/Göthingen, Heidelberg and I.F. Bergmann, München. 1951. DM 136.

The well-known first edition of this book has been in the process of being re-edited since 1939; the new edition gives an excellent picture of the enormous progress that wood technology has made since 1936. Owing to the vast amount of research carried out in this field, Kollmann's monumental work is divided into two volumes, one dealing with basic science such as the anatomy, pathology, chemistry, physics, elasticity and strength of wood and derived products, and the second — still in preparation — dealing with the industrial processes of drying, preserving, jointing, woodworking, wood modification and utilization of waste products. The present volume contains an excellent survey of the macroscopic and microscopic structure of wood; of its defects; and of all wood destroying fungi and animals.

The chapter on Wood Chemistry begins with its submicroscopic structure, its composition and the currently used analytical methods, stressing the fact that until now no generally accepted analytical methods have existed so that the comparison of results of investigations in this domain is still very precarious. This chapter also contains — in contrast to those on mechanical properties — a condensed technology of manufacturing processes for pulping, saccharification, burning, distillation and gasification and a detailed section on chemical resistance and the corrosive properties of wood.

Both the physical and mechanical properties of wood are discussed thoroughly including much original research by Kollmann and his collaborators in the two important institutes under his direction, namely the "Reichsanstalt für Holzforschung" at Eberswalde/Berlin up till 1945 and the "Bundesanstalt für Forst und Holzwirtschaft" at Reinbek/Hamburg since the war.

Comparative tables of different national standards, a bibliography with more than 10,000 references, lists of commercially important species grouped alphabetically by trade names and by botanical names contribute, together with almost 1,000 figures and a large number of tables, to make this work a most useful handbook for research workers in the field of wood technology.

Northeastern Loggers' Handbook. Fred C. Simmons. U.S. Department of Agriculture Handbook No. 6. 160 pp., illus. U.S. Government Printing Office, Washington D.C. 1951. $0.75.

Presenting the "tricks of the trade" in logging, this illustrated handbook should serve well to explain how the job can best be done. It describes the use and care of tools, the most practicable of the old and newly-developed logging methods and equipment, and in particular how important safety measures are to wood workers. The drawings throughout the book illustrate these safety measures well and show how simple precautions can play an important part in reducing the accident rate in forest operations.

The book describes in detail for the northeastern United States, the choice, care and use of the axe, the crosscut saw, the bow saw, power saws, peavies and peeling tools. It contains information on felling, limbing and bucking, skidding, log hauling in winter, construction of all-weather roads, and logging truck operation. An especially valuable part of the book is the 7½ page glossary defining the interesting, but often confusing, terminology of the logger's jargon.

The emphasis throughout is on the practical everyday "how-to-do-it safely" approach to each tool, piece of equipment, or method used, and should therefore prove valuable to training programs for forest foremen and workers. Similar books have been prepared along these lines in several other countries ; more countries might well consider the desirability of doing the same for their particular conditions.

Wood Preservation during the last 50 years. Dr. H. Broese van Groenou, H.W.L. Rischen and Dr. J. vom den Berge. 318 pp., 60 fig , 76 tab. A.W. Sijthoff's Uitgeversmaatscappij N. V., Leiden, Holland. 1951. Fl. 24.

With the assistance of the principal research institutes of the world dealing with wood preservation problems the authors have endeavored to survey the considerable scientific and practical progress achieved in this field.

After a short historical introduction they discuss basic questions which until now have scarcely been dealt with — the natural durability of wood and the economic importance of its preservation. They next discuss the wood deteriorating agencies and the methods of wood processing. The second chapter deals in detail with almost all commercially important wood preservatives, grouped into oily liquids, metallic and organic compounds. The third chapter describes the scientific research carried out on these preservatives. A list of research institutes grouped alphabetically by countries gives a short survey of the main lines of investigation followed by each of them. Testing methods — still badly in need of an international unification — are clearly described and the selected bibliographies at the end of each chapter give about 1,300 references.

Sixty figures, 76 tables and a well arranged index contribute to the usefulness of this work.

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[1] Gen. = *General*
Fund. Sc. = *Fundamental Science*
Silv. = *Silviculture*
Log. & Eng. = *Logging and Engineering*
For. Inj. & Protec. = *Forest Injuries and Protection*
Mens. & Surv. = *Mensuration and Surveying*
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